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The American STATISTICIAN

The news publication of the
AMERICAN STATISTICAL ASSOCIATION

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The American STATISTICIAN

February 1949, Vol. III, No. 1

The news publication of the
American Statistical Association

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HIGHLIGHTS OF THE ANNUAL BUSINESS MEETING

Because of the significance to the profession of the discussion at the Annual Business Meeting of the American Statistical Association—held in Cleveland in December 1948—we are not printing an editorial in this issue of *The American Statistician*, but are devoting the space instead to some of the reports and resolutions submitted at that meeting.

REPORTS

The year we have just passed through has been one of serious, one might say, unprecedented financial problems for the Association. As the report of the Secretary-Treasurer pointed out, membership of the Association remained almost at a standstill during 1948; new members were not quite sufficient to offset the losses. This is a reversal of the trend from 1944 through 1947, during which membership increased steadily. The income of the Association during 1948 was about $52,000, while its expenses were about $65,000. This operating deficit of approximately $13,000 occurred in spite of a $10,000 increase in revenue over that for 1947. This abnormally large deficit was attributed to the Association's failure to grow in membership during the year; to the fact that advertising and circulation receipts were less than anticipated, and to the continuing rise in printing and operating costs.

The report of the Board of Directors to the membership took note of this situation and characterized the past year as "one of unavoidable financial stress and structural reorganization." The emphasis for the coming year was placed on organization and financial consolidation. While this involves substantial retrenchment and greater use of volunteer help, it also means a drive for membership and an expansion of carefully selected activities. The Board of Directors is now studying the financial condition of the Association and will shortly submit its recommendations for the 1949 budget to the Council.

RESOLUTIONS

A resolution, submitted by Eugene Pike and voted by the meeting, expressed approval of the trend toward greater membership participation and internal democracy which the new Constitution is expected to foster. The Pike resolution provides that, where it is deemed to be in the interests of the membership, the Council is to state what matters of policy lie before it and to solicit the membership's views on these matters. This resolution parallels a provision of the Constitution, which went into effect on January 1, 1949, providing that "regular sessions of the Council shall be open to members of the Association who shall have the right to speak on any issue under discussion, but not to vote." In the discussion on the Pike resolution, it was recommended that one half day of every Annual Meeting be set aside for a business meeting so that the membership would have ample opportunity to prepare resolutions and discuss all pending policy issues.

A resolution introduced by Aryness Joy Wickens, providing that a special subcommittee be established by the Committee on Committees to formulate standards for the selection of Fellows in the American Statistical Association, touched off heated discussion. There was disagreement concerning the standards for the selection of those "statisticians of established reputation" who, according to the Constitution, are eligible for Fellowship. Mrs. Wickens felt that too great stress had been placed on mathematical statistics, whereas Dr. Harold Hotelling urged that knowledge of at least the fundamental mathematical basis of statistics be a pre-requisite of selection. The Business Meeting voted that a special sub-committee be set up to consider the standards for Fellows. If approved by the Board and Council, the sub-committee's recommendations would constitute the criteria for the selection of future Fellows.

A resolution, which was carried by voice vote of the Annual Business Meeting, pointed out that a large portion of the ASA membership is primarily interested in the social sciences and stated that many expressions of dissatisfaction have been received concerning the service rendered social scientists by the Association. Accordingly, both the Council and the Board of Directors were requested to give serious consideration to means of providing a balanced program to meet the wants of the membership as a whole.

The Business Meeting touched on more controversial matters than is usual in such gatherings. It seemed clear that the membership is becoming increasingly interested in active participation in policy determination. We feel that this is an encouraging development. The tasks of the Association, according to the Constitution, are: to foster the development of statistics in the broadest possible manner; to promote unity of effort among those concerned with statistical work, and to increase the contribution of statistics to human welfare. These ends can most rapidly be advanced if the entire membership concerns itself with them.

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NEWS

ASA elections—votes of the 1949 Council—Civil Service examination for statistician—Soviet statistics—meetings—new publications

American Statistical Association Election of Officers for 1949

President:	Simon Kuznets	*Directors:*	
President Elect:	Samuel S. Wilks	(3 year term)	Cyril H. Goulden Louis L. Thurstone
Vice-Presidents:		*District Representatives:*	
(3 year term)	Dorothy S. Brady	Western	Maurice I. Gershenson Henry B. Moore
(2 year term)	Harold A. Freeman	North Central	Howard J. Jones
(year term)	Lester S. Kellogg	Southeastern	Morris H. Hansen

The AMERICAN STATISTICAL ASSOCIATION has announced the election of four of its members as Fellows—three American statisticians and one Canadian Statistician. (There are now 145 Fellows of the American Statistical Association from a total membership of about 4,700.)

The newly elected Fellows are:

Eugene L. Grant, Professor of Civil Engineering at Stanford University, who has developed special courses for teaching statistics for engineers, and who has been a leader in the practical application of statistics to engineering.

Tjalling J. Koopmans, of the Cowles Commission for Research in Economics at the University of Chicago, who has done outstanding work in the application of statistics to economics.

W. Allen Wallis, Professor of Statistics and Business Economics at the School of Business at the University of Chicago, who was Administrative Director of the Statistical Research Group of the Office of Scientific Research and Development which developed and supplied answers to many statistical problems of military importance submitted by the armed services.

J. W. Hopkins, Canadian biometrician, of the Division of Biology and Agriculture of the National Research Laboratory of Canada and Coordinator of the Special Committee on Applied Mathematical Statistics, of the National Research Council of Canada. His principal work has been done in applying statistical methods to experiments with grains and livestock. During the war he served as scientific advisor to the Air Vice Marshall of Canadian anti-submarine warfare.

U. S. Civil Service closing date for Statistician Examination extended

Unassembled examinations for statistical positions have been announced by the U. S. Civil Service Commission. From these examinations the Commission will establish registers of eligible competitors for positions as mathematical, analytical and survey statisticians at grades P2-P4, beginning salaries $3,727 to $5,232; Statistical Assistants CAF 7-9, $3,727 to $4,479; Statistical Officers, CAF 10 to 13, $4,855 to $7,432.

Duties of the statisticians will include development and application of methodology and planning of surveys. Statistical Assistants and officers will administer, supervise and perform non-professional work in statistical projects. Positions to be filled will be in the Washington, D. C., area.

No written examination will be held. Applications will be judged on the basis of education and experience. Complete information about the examinations is contained in Announcement No. 152 (Unassembled) which may be obtained from Civil Service Regional Offices or from the Civil Service Commission, Washington 25, D. C. Despite the fact that the last date for filing shown on the announcement is February 23, we have been informed by the Civil Service Commission that the closing date has been extended to March 30.

Special summer session in Survey Research techniques

The Survey Research Center of the University of Michigan will hold its special summer session in Survey Research Techniques from July 18 to August 13, 1949.

The following courses will be offered: Introduction to Survey Research, Survey Research Methods, Sampling Methods in Survey Research (elementary and advanced), Mathmatics of Sampling, Statistical Methods in Survey Research, Techniques of Scaling.

In addition the introductory courses will be given from June 20 to July 16. This will permit students who are attending the full eight-week summer session of the University (June 20 to August 13) to register for the introductory courses during the second four weeks.

It is expected that this special session will attract men and women employed in market research or other statistical work and university instructors and graduate students with a particular interest in this area of social science research.

All courses are offered for graduate credit and students must be admitted by the Graduate School. Inquiries should be addressed to the Survey Research Center, University of Michigan, Ann Arbor, Michigan.

First Meeting of the ASA Council

The Council of the American Statistical Association, created under the new constitution and consisting of all of the regular officers of the Association, representatives of the 6 districts of the Association, and the editors of Association publications, held its first meeting in Cleveland on December 29, 1948. The following matters were voted by the Council in the course of its first session.

It was VOTED to elect Merrill M. Flood to the office of Secretary-Treasurer. Mr. Flood was seated as Secretary of the Council.

It was VOTED to elect the following three members to the office of Editor: William G. Cochran (Journal of the ASA); Sylvia C. Weyl (The American Statistician); Gertrude M. Cox (Biometrics).

It was VOTED to establish six Districts of the Association, on recommendation of the Board, each determined by designating the Chapters in its area—as follows: Northeastern District: Albany, Boston, Connecticut; Eastern District: Central New Jersey, Harrisburg, Ithaca, New York, Philadelphia; Southeastern District: Associacion Cubana de Estadistica; North Carolina, Washington Statistical Society; North Central District: Central Indiana, Chicago, Cincinnati, Cleveland, Columbus, Detroit, Madison, University of Illinois; South Central District: Austin, Oklahoma City, St. Louis; Western District: Denver, Hawaii, Los Angeles, Pacific Northwest, Sacramento Statistical Association, San Francisco.

It was VOTED to elect the following Committee on Committees: For one-year term: Aryness J. Wickens, Joseph Berkson; for two-year term: R. W. Burgess, Henry Chauncey; for three-year term: Walter S. Shewhart, Helen M. Walker.

It was VOTED to approve the concept of Statutes and Regulations, to direct the Board to prepare a draft of Acts for Council action in December 1949, and to authorize the Board to act during 1949 as Executive Committee for the Council.

It was VOTED to designate the Secretary-Treasurer as the principal executive of the Association, and to direct him to act during 1949 in a manner consistent with the constitution, by-laws, approved budget, and current unwritten policies and procedures of the ASA in fulfillment of its program—turning to the Board with any recommendations for change in policy, budget, or procedure felt needed before 1950.

It was VOTED to refer the following resolution; presented by Aryness Joy Wickens on the floor of the annual business meeting, to the Committee on Committees:

RESOLVED, that a special sub-committee be set up by the Committee on Committees to consider and formulate specific standards for the selection of Fellows, in carrying out the constitutional provision that Fellows shall be "statisticians of established reputation"; that the recommendations of this special sub-committee be forwarded to the Board and Council for its approval; whereupon the approved standards shall constitute the criteria for the selection of Fellows.

It was VOTED to request that the Committee on Committees give first priority in its work to the clarification of the status of Sections. It was AGREED that the present status of Section Committees under the new constitution would be the same as that of other temporary committees appointed by the President, and that their eventual status is to be decided after consideration of the recommendations of the Committee on Committees concerning the structure of the Association.

A petition for the establishment of a Business Statistics Section was presented to the Council. It was AGREED that the business statistics group should be presented by a temporary committee to be appointed by the President, similar to the other two section committees, until such time as a recommendation is forthcoming from the Committee on Committees.

It was VOTED to elect the following representatives to other associations: Frederick C. Mills to a two-year continuation term on the Board of Directors of the National Bureau of Economic Research; Forest Linder for a one-year term as representative to the Inter-American Statistical Institute; Donald Riley as representative to the American Documentation Institute; Margaret J. Hagood for a one-year term as representative to the Advisory Board of the American Yearbook.

It was VOTED to approve the election of Philip M. Hauser as representative on the Social Science Research Council for the term 1949-51. This action was taken to confirm a previous action by the 1948 Board of Directors on April 28, 1948.

It was VOTED to accept the report of the Commission on Statistical Standards and Organization, as presented by Isador Lubin at the annual business meeting. President Kuznets asked that Mr. Lubin submit a resolution to the Board and Council that would clarify the action he proposes to take concerning the government projects submitted for consideration by the Commission. He asked that this resolution also make clear to what extent the ASA is involved with the statements of the Commission and to indicate that statements of the Commission are not binding on the other members of the Association. Mr. Lubin stated that the Commission would undertake only those projects for which provision is made in the budget.

Seventh International Conference of Labour Statisticians

The following agenda will be considered in the fall of 1949 at the International Conference of Labor Statisticians:

(1) international standard classification of occupations; principles of classification and allocation of particular occupations;

(2) Statistics of payrolls and earnings: methods of obtaining statistics of earnings as well as of total wages and salaries from payroll data;

(3) Methods of family living studies: techniques and methods of family living studies, with special reference to the application of sampling procedures, standard accounting methods and uniform comparisons;

(4) Methods of statistics of productivity of labour: standard basic data for calculating the productivity of labour for international comparisons.

Publications of the National Bureau of Standards

A list of all the Bureau publications from 1901 to June 30, 1947, are now available. The National Bureau of Standards is the principal agency of the Federal government for fundamental research in physics, mathematics, chemistry, and engineering. The publications listed include Mathematical Tables, Building Materials and Structure reports, Circulars, Handbooks, Commercial Standards, Simplified Practice Recommendations, Research Papers, and Miscellaneous Publications.

Circular No. 460, *Publications of the National Bureau of Standards*, 375 pages, can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at a cost of 75 cents a copy.

Social Science Research Council Committee on Analysis of Pre-Election Polls and Forecasts

From an official statement of the Committee

The reliability of Public Opinion Polls

The failure of the public opinion polls to predict correctly the outcome of the 1948 presidential election has created wide confusion and misgivings about the reliability of the polls. Reactions of the public to the polls have ranged from charges of outright fraud to expressions of personal sympathy for the pollsters. Reactions of experts ranged from condemnation for carelessness, unintentional bias, errors of judgment, and use of outmoded techniques, to a determination to make use of this experience to enlarge our knowledge of political behavior and to improve survey methodology.

The Committee on Analysis of Pre-election Polls and Forecasts was set up by the Social Science Research Council to make an immediate examination of available information about the polls and the election in order to discover as far as possible the causes of the errors in the forecasts and to make recommendations for the improvement of polling methods. In accepting this assignment, the Committee recognized the urgency of completing the analysis and reporting their findings while the relevant information was still fresh and before various gross misconceptions became crystallized. The Committee, as a technical group, has not been able to undertake an exhaustive study of the problems involved. It is hoped that further studies of many of their aspects will be pushed vigorously by students of polling methodology and political behavior.

The Committee wishes to acknowledge its appreciation to the various polling organizations and especially to Messrs. Crossley, Gallup, and Roper for their wholehearted cooperation. They have responded to every request of the Committee for data and explanations.

THE COMMITTEE

James Phinney Baxter, 3rd, President of Williams College
Philip M. Hauser, Associate Dean, Division of Social Sciences, University of Chicago
Carl I. Hovland, Chairman of the Department of Psychology, Yale University
V. O. Key, Professor of Political Science, The Johns Hopkins University
Isador Lubin, Chairman of the Committee on Statistical Standards of the American Statistical Association
Frank Stanton, President, Columbia Broadcasting System
Frederick F. Stephan, Professor of Social Statistics, Princeton University
Samuel A. Stouffer, Professor of Sociology, Harvard University
Samuel S. Wilks, CHAIRMAN, Professor of Mathematical Statistics, Princeton University

The Committee also wishes to commend the pioneering work that these men have done in the field of public opinion polling, a broader and more important activity than pre-election forecasting. Public opinion polling is only in its infancy and if soundly developed and properly utilized it will be of great assistance in understanding political and social behavior. Sound development requires the cooperation of the polling organizations and social scentists.

The Committee wishes to acknowledge the assistance of a staff of five able young social scientists and statistical experts who worked for five weeks under considerable strain and inconvenience on the detailed analysis of many problems which confronted the Committee. The work of the staff will be published in a separate monograph.

The Committee has made a study of available data on the 1948 election forecasts and has come to the following conclusions:

Conclusions

1. The pollsters over-reached the capabilities of the public opinion poll as a predicting device in attempting to pick, without qualification, the winner of the 1948 presidential election. They had been led by false assumptions into believing their methods were much more accurate than in fact they are. The election was close. Dewey could have won by carrying Ohio, California, and Illinois which he lost by less than 1 percent of the vote. In such a close election no polls, no advance information of any kind, could have predicted a Truman or Dewey victory with confidence. The failure of the polls was due to neglecting the possibility of a close election and the necessity of measuring preferences very accurately just before the election to determine whether a flat forecast could be made with confidence.

2. The pollsters could have foreseen the possibility of a close contest had they looked more carefully at their data and past errors. They acted in good faith but showed poor judgment in failing to apply in 1948 what they knew about their past errors, and failing to ascertain late campaign shifts.

3. The overall operation of making election predictions from pre-election polls is a complex one involving eight major steps at each of which error may enter. It is very difficult to unscramble the total error and allocate components of it to these various steps. The evidence indicates that there were two major causes of errors (a) errors of sampling and interviewing and (b) errors of forecasting, involving failure to assess the future behavior of undecided voters and to detect shifts of voting intention near the end of the campaign.

4. These sources of error were not new. While Gallup and Crossley were more successful in picking the winner and his electoral vote in 1940 and 1944 than in 1948, their average errors state by state were at least half as great in the two preceding elections as in 1948. Hence, it is possible that their errors in 1948 were due to much the same causes as those that produced the earlier forcast errors, but if so, these causes operated more strongly. Roper's wide discrepancy in 1948 cannot be explained so readily in terms of factors present in his earlier close estimates of the national vote. It appears to be due to the upsetting of the balance previously maintained among various factors in his polling operations.

5. To improve the accuracy of pre-election poll predictions satisfactorily it is necessary to reduce the error at every step in the over-all polling process. The error at some of the steps, notably sampling and interviewing, could be reduced by using methods now available But reduction at other steps depends on further basic research in psychological and political behavior.

6. The manner in which the pre-election polls were analyzed, presented and published for public consumption contributed materially to the widespread misinterpretation of the results of the poll and to the great public reaction to their failure to pick the winner. This led to a poor understanding of the lack of accuracy of the polls and of the nature of the errors residing in the polls, with the result that the public placed too much confidence in polls before the 1948 election and too much distrust in them afterwards.

7. The public should draw no inferences from pre-election forecasts that would disparage the accuracy or usefulness of properly conducted sampling surveys in fields in which the response does not involve expression of opinion or intention to act. There are more appropriate methods to check the accuracy of such surveys.

Forecasts

Election forecasts from polls are hazardous. This fact might tempt some polling organizations in the future to limit their political studies to attitudes which cannot be checked up at elections. Thus, they could avoid the spotlight of a public audit of their work. The Committee would view such a step with concern, for all possible tests of opinion studies are needed. Election returns are not a direct or even a good test of the adequacy of polling on issues, like the Marshall plan, civil rights, etc. But elections are useful for testing the adequacy of polling methods for estimating the percentage of the vote going to each candidate from various groups in the population. No better test is now known. Even in the case of these estimates, it will not be possible to make election returns a satisfactory test unless pre-election studies and post-election studies are more rigorously designed so that different types of errors can be partitioned out. The responsibility rests squarely on polling agencies, in cooperation with social scientists, to work out such designs.

Apart from their use in election forecasting, opinion polls conducted in relation to elections have great value in giving social science and the public a better understanding of the American democratic process. Such polls do two things:

(a) They reveal the voting preferences and voting behavior of different parts of the population, such as men and women, old and young, etc.

(b) They reveal the relation between opinion on important issues and the choice of the candidate for whom the voter casts his ballot. In addition, they reveal the opinions and preferences of those people who do not turn out to vote.

On the basis of its study the Committee makes the following recommendations:

Recommendations

1. To improve the accuracy of polls, increased use should be made of the better techniques now available, particularly in sampling and interviewing. Since the reduction of any part of the error greatly increases the chances of a successful forecast, the Committee urges that polling organizations exert every effort to adopt more reliable techniques.

2. Increased attention should be paid to the development of research on each step of the polling operation to attempt to improve methods used in opinion research. This would include research on sampling methods, interviewer bias, concealment of opinions, selection and training of interviewers, etc. Experimental studies of such problems should be incorporated into regular survey operations and as a part of more general cooperative studies of specific communities.

3. Research should be expanded on the basic sciences, particularly social psychology and political science, which underlie the analysis of voters' behavior. Even if perfect sampling of individuals is employed, we now know too little about voting intentions, factors affecting change in opinion, prestige effects, and similar topics to predict who will translate his opinion into actual voting.

4. In view of the increasing amount of emphasis being placed on public opinion polls, the Committee considers it very important for the public to be effectively informed about the limitations of poll results so it can interpret them intelligently. It urges that polling organizations, newspapers and magazines, and social scientists who work with poll results help provide the public with more information about polls, their interpretation and limitations.

5. There should be more effective cooperation between research workers interested in opinion measurement on common problems of methodology, underlying theory, and research design, including more studies of validity and reliability than have been made heretofore. Such cooperation would benefit all parties through the wider dissemination of their findings, and more efficient use of research resources and opportunities for experimentation.

6. More extensive training facilities and opportunities for practical experience under effective supervision should be provided for students who may be interested in research careers in this field, which includes political behavior, psychological research, and opinion measurement and statistical methods.

7. Analysis of the elections is greatly hampered by long delays in the reporting of official returns. The present inadequacies with respect to the collection of election statistics should be remedied by effective organization for rapid and accurate reporting of election statistics at the local, state and national level.

Memorandum on Statistics in the Federal Government

PART I-Chapters I-IV

by JOHN W. TUKEY

I
General

1. Summary

The statistical program of the federal government is well-organized, perhaps better than that in any other scientific field. The key to improvement is not in major reorganization, but in maintaining and expanding a relatively small group of highly trained personnel, and in making their skills more useful, particularly by strengthening central professional leadership and encouraging inter-agency loans of specially skilled statisticians.

This paper outlines a systematic framework for the federal statistical program and relates a number of recommendations to this framework. In the hope that this framework will prove helpful in discussing the place of statistics and the location of statistical groups and agencies in any forthcoming reorganization of the executive branch of the federal government. Many of these recommendations are based on the views of professional statisticians who are members of the American Statistical Association.

2. Introduction

The American Statistical Association desired to cooperate helpfully and very informally in the work of the panel led by Professor Frederick C. Mills. This panel conducted a survey of the statistical program of the federal government, under the sponsorship of the National Bureau of Economic Research, for the Commission on the Organization of the Executive Branch, set up by Congress under the chairmanship of Herbert C. Hoover.

Since it was felt that some expression of the views of professional statisticians might be helpful to the Mills panel, the writer was asked to prepare a memorandum on this subject. A considerable number of professional statisticians were asked for comments. Face-to-face discussions were held with an overlapping group.

The broad, general conclusions from these contacts with professional statisticians, both inside and outside the government were two-fold:

(A) The statistical program of the government is well-organized, perhaps better than that in any other scientific field (This does not mean that it is perfect.)

(B) Efficiency of operation inside this, or any similar, organizational structure requires maintenance and expansion of a relatively small group of highly trained personnel.

If these broad conclusions be correct, then there is no great gain in efficiency for the government statistical program from major reorganization—from shifts of this Bureau to that Department or this group to that Bureau. (The article by Morris A. Copeland in the June, 1948, *American Statistician* points toward some desirable clarifications and shifts of emphasis.)

The central problem is personnel, attracting trained men, keeping them through pulsations of activity until they acquire seniority, keeping them contented in the face of uncertainties based on Congressional decisions.

However, other reasons may lead to more or less general regroupings of the federal government, in the near or distant future. There is gossip of new departments organized on new lines, etc. If such changes are to come, their minor details should be such as not to reduce the efficiency of the government statistical program. The real program is to set up guide posts for an unknown change.

The most feasible way to attempt this seemed to be to prepare an account on general principles of the statistical program of the federal government and of its functions, in the hope that this would be useful in almost any frame of organization. Into this there could be fitted various suggestions and recommendations which had been gathered from professional statisticians. This plan has been followed.

After some general considerations, the account is organized as follows: Chapters II, III, IV and V on the four statistical functions of reporting, analysis, consultation and research, Chapter VI on personnel problems. Chapter VII on the assessment and evaluation of government statistics.

3. The Functions of statistics

A recent and reasonably neutral example for broadly describing the different functions of statistics is furnished by the Army Air Forces and its supporting agencies during the last war. The writer had contact with only a small part of Army Air Force statistical activity, and it should be emphasized that the example is descriptive rather than critical.

The function of "reporting" was carried on at many levels by the Statistical Control Branch, which also had analytical functions. In its reporting function, this branch provided the commanders of groups, air divisions, air forces, and, especially in the staff in Washington with what might broadly be termed

accounting information. How many tons of bombs were dropped in June? How many flying hours of AT-6 flying time per fatal accident? How many flexible gunners will graduate from training in September? All this was numerical information on action already taken which could be directly gathered and whose usefulness was clear in advance. This branch reported directly to the Chief of Air Staff, who was the Commanding General of the Army Air Forces, and drew its information from Statistical Control officers in combat and training groups and in schools.

In slight contrast to this was another aspect of the reporting function, the inspection of lots of manufactured product by single sampling. Here the analyses and decisions had been made in advance, and a count of the number of defectives in a sample of fixed size determined whether the lot was accepted or rejected. The executive here had been mechanized and converted into a table. The reporting function provided this mechanical executive with directly gathered information whose usefulness was clear in advance, and the mechanical executive's decision was based on that information.

As shown by this example, *the main task of the reporting function is to supply policy-makers and executives at all levels from the lowest to the highest with that numerical information which can be directly gathered and whose usefulness is clear in advance.*

The function of analysis was divided. For combat operations it was carried out by the Operations Analysis groups, the central group in the Pentagon and the groups with the individual Air Forces. Most of the personnel engaged in this work were not professional statisticians and rightly so, but much of their work was statistics in the broadest sense. They studied the effect of tactical dispositions on the number of bombs "on target", having first found out how to assess that number. They studied the effect of the direction of attack on a particular target on the probable losses to anti-aircraft fire, having first learned how to assess those probable losses in terms of the enemy's guns and equipment and the course flown by the bomber. They studied the probable weather for the next x months, and assessed its effect on the strategic value of shuttle bombing. And many other things as well.

The analytical function for production and general scheduling was carried out by the Statistical Control Branch and by many decentralized agencies.

In learning to operate a huge training program effectively, the Army Air Forces made great use of statistics and statistical analysis in improving the methods of selection and of training.

In all these cases, the work had two phases: (a) the study of future, planned or possible operations—trying to assess what their results would be—and (b) the analytical study of past operations—peering beneath the surface to search for important clues to better future action. This second phase seems close to the reporting function, but the cleavage is deep and important. Personnel and organizations suited for one are not likely to be suited for the other. As shown by this example *the analytical function of statistics is two-fold, to study the probable effects of future, planned or possible operations and to analyze the results of past operations deeply, seeking for valuable hidden information.* This function will and should be carried out by many, a few of whom will be professional statisticians.

The function of "consultation" was decentralized in the Army Air Forces, as it should have been, for the job of providing guidance in planning and interpreting experiments and programs of observations should be done in close cooperation with those actually carrying out the work. In the case of the Army Air Forces, most of this experimental work came in connection with research and development work. Contractors of the Army Air Forces, the National Defense Research Committee, the Committee for Medical Research, or the Manhattan District of the Corps of Engineers were actually carrying out the research and development work, and their diversity and number makes it hard to fairly assess its extent and value.

Since the actual interpretation of experiments is analysis, and since every consultant has to do some of this to get the feel of the problem, it may seem hard to draw the line between consultation and analysis. The earmarks of the consultant are interest in method and active cooperation with various workers. A given statistician can mix analysis and consultation in almost any ratio, but if he does consultation, he is a consultant.

The Army Air Forces do not provide simple and really good examples of two further important ways in which the consultant works. These are in applying new and better statistical methods in reporting and in analysis. For the statistical program of the federal government these are of the greatest importance.

The consultant function of statistics is to cooperate with others in the planning and interpretation of experiments, surveys, and procedures for reporting and analysis.

The function of "research" was to a large extent concealed in the Army Air Forces. For research usually takes years to produce operational results. The research on which some of the Army Air Force statistical work was based went back five, ten or twenty years. A prominent exception to this was the development of Sequential Analysis as a tool in the efficient inspection of industrial production. This was started during the war, and widely applied before its end. Less prominent, but more directly effective was work done on the theory of bombing and

aircraft gunnery, which it would be inappropriate to describe here. This last sort of research is closely related to analysis, but could easily be distinguished, since the formulas or tables developed by research were sent overseas for use by the Operational Analysis Groups. As shown by this example, *the resarch function in statistics is to supply the reporting, analysis, and consultant functions with the tools to do new things well and old things better.* The research function *in* statistics is to be carefully distinguished from the research *of* statistics *in* economics, management or public health, which is usually analysis, but may be consultation or reporting.

The example is intended to give a broad idea of the four functions of statistics, with differing degrees of centralization, and different percentages of professional personnel. The results are summarized in the following table:

will be use of reporting and analysis statistics at all levels, by the individual executive, the agency head, the secretary of the department, the president, or by some of their assistants. Here the organization is relatively direct, and it is relatively easy to see some of the channels through which statistics must flow if the executive branch is to function smoothly.

Equally concerned is the Congress, whose policy-making and supervisory functions entitle it to reporting and analysis statistics which are of the utmost importance for its wise, efficient and effective conduct of the nation's affairs. Many of the members of Congress, at any time, are recently elected and have come from professions and fields of activity where statistical information is not as necessary as it is in the affairs of a large and complex country. The channels through which government statistics reach them deserve especial attention.

THE FUNCTIONS OF STATISTICS

Function	Purpose	Organization	Personnel
REPORTING	to supply policy-makers and executives with numerical information which can be directly gathered and whose usefulness is clear in advance	coordinated — often stretching from field agencies to staff groups	originally accountants and general quantitatively minded personnel, as newer methods are employed, more statisticians will be required
ANALYSIS	(a) to study the probable effects of future, planned or possible operations, (b) to analyze the results of past operations deeply, seeking for valuable hidden information	small or medium sized groups, some in reporting organizations, others at staff levels	some statisticians and many specialists in subject-matter fields such as economics, mining, etc.
CONSULTATION	to cooperate with others in the planning and interpretation of experiments, surveys, and reporting and analysis procedures	consultants attached to individual groups, preferably supplemented by a few small central groups	statisticians of various mixtures of theoretical and applied training
RESEARCH	to supply reporting, analysis, and consultation with the tools to do new tasks well and old tasks better	depending on circumstances	statisticians with deep theoretical knowledge and some applied experience

4. The users of government statistics

In our example of the Army Air Forces, the users of statistics were diverse enough, from the inspector on the industrial production line to the commanding general. The relatively direct chain-of-command organization of the Army Air Forces helped to keep the situation relatively simple—each piece of statistics came in to one, or perhaps a few, natural places in the organization. This sort of relative simplicity does not exist in the use of federal government statistics, and it will pay us to consider the various users briefly.

In the executive branch of the government there

The state and local governments are major consumers of government statistics, and producers of reporting and analysis statistics on their own account. Their needs are important, too, since we depend on the joint action of federal, state and local governments for the conduct of the affairs of the country. The nature of their needs, and the extent to which they are being met, can be discussed adequately only by those with experience at these levels.

The United States operates to a large extent on a system of free enterprise. This means that the grocery business, for example, is managed, not by a central agency, but by many diverse managers, in

factories, canneries, wholesale houses and retail stores. If they are to make wise decisions, and the country counts on them to do so, they must have the necessary statistical information on which to base these decisions. The problem of a statistical service for many thousands of dispersed, isolated, and sometimes antagonistic policy makers is not an easy one, and the current solution should be re-examined frequently. It is not enough to think of the individual business man as a consumer of statistics, as an executive and a policy-maker, but we must think of the distributed management of each of the professions, trades, and industries, manufacturing or service as a composite executive and policy-maker.

These business users are using statistics for control of their operations and for the forecasting of the results of future operations at an ever increasing rate. Tomorrow they will need, and need urgently, new statistical series which no one considers today. Much of this information must come through government channels, since business privacy would prevent any private organization from gathering such data. The value to the nation at large of the soundness of their decisions must be the first test of the importance of collecting and getting such statistical information to them.

In this category we must include not only the companies who own the steel mills, but also the unions of steel workers, for the country has a great stake in the soundness of the decisions on both sides.

Finally, we must consider the ultimate policy-makers—the voters. As the final arbiters, they too are entitled to statistical information both reporting and analytic. Now we have the problem of reaching tens of millions of policy-makers, presumably through the press and radio.

In discussing these different users, we have spoken again and again of reporting and analytic statistical information. The consulting function has not appeared. This is natural, for the products of reporting and analysis are visible in tables and reports, which pass up the line, being summarized, condensed and resummarized. The product of consultation is more efficient and effective operation at the working level—more useful, less expensive, better interpreted experiments and surveys. It is the invisible export of better results for less money which goes to higher executives, to congress,, to state and local governments, to business, industry, organizations, and to the voters. Invisible, but not to be neglected.

5. The reliability of figures

It is often said that this is a scientific world—it been an engineering world for a long time. Yet the average citizen thinks of numbers like a banker, rather than like a scientist or engineer. The viewpoint of the auditor, who checks each ten-cent item, in order to catch the occasional petty thief before he becomes an embezzler, is appropriate for *dealing with money after the fact*. In planning a broad program it makes little sense to consider the odd 16 cents in a 3 million dollar item. In reporting the sales of automobiles in a year, the single dollars, the tens, and so on for quite a few figures to the left of the decimal point are of no practical service.

When the Bureau of Standards says that this is a one-pound weight, no physicist or engineer believes that it is exactly one pound. For the Bureau has worked hard to learn the accuracy of its measurements and it supplies with each weight a certificate indicating how much the weight may differ from exactly one pound. The calibration of the weight is valuable *just because* its possible error is known. When the Bureau of the Census makes an enumeration, there are errors, which they acknowledge. They know the extent of the errors from many sources and they try to learn more about those from others. Some lie mainly outside their responsibility, like the world-wide tendency of the person interviewed to forget the baby when asked the names of all the persons in the house.

If statistical information is to be most valuable to any or all the users mentioned above, they must learn *not to take figures uncritically*. Anything which can be done to spread an appreciation of

(1) the fact that all figures, except possibly an audit, are subject to error,
(2) the importance of known reliability, both as to fluctuation and bias, for any figure,,

will do much to improve the efficiency of the statistical program of the federal government, for its efficiency is measured by the decisions based on its product and not by the number of volumes of tables prepared. It may well be more efficient to obtain a few figures of known reliability than to obtain many "just figures".

The appreciation, and effective use, of figures of known reliability has grown rapidly, both inside and outside the government. This growth has gone hand in hand with the recent rapid improvements in getting figures with known reliability for less cost, changing statistics from a graveyard of dead facts to an efficient tool of administration and management.

As further thought and attention is given to figures of known reliability, there will be an inevitable increase in the care with which figures competently and suitably collected are distinguished from forecasts, and just guesses. In many fields, estimates of known accuracy are now possible, but similar estimates are needed in many more. It is far easier to put out a figure, than to accompany the figure with a wise and reasoned account of its liability to systematic and fluctuating errors. Yet if the figure is this year, next year or in 1975—going to serve as the basis for an important decision, the accompanying account may be more important than the figures themselves. We must emphasize that the policy-maker

or executive for whom figures are gathered today may still be in kindergarten!

Once upon a time decisions based on numbers were frequently a matter of impression, when large errors really were not serious. There was usually slack to be taken up. Today a 10% change in steel production has a really strong effect on all industry. We are not building excess steel production to take care of booms—instead we are trying to operate with small margins and without appreciable slack. This means a many-fold increase in the importance of reasonably accurate numbers of known and reliable accuracy.

6. The place of sampling

It is this growing appreciation of the variability of figures, and the consequent inquiry into how precise the figures should be to meet the need, which has made it possible for sampling methods to provide more information for less money during the last few years. Sampling is ideally adapted to producing results subject to known amounts of fluctuation and to investigating the possible causes of systematic errors.

The use of sampling has spread widely, but there is no reason to believe that it has reached anywhere near its full growth, inside the federal government, or out. There will be more sampling of more things as time goes on. It is true that there has been foolish sampling and that there may be more, for useless or false information can be obtained from a sample as well as from a complete survey. But in such cases the foolish decision was not the decision to sample but rather the decision to gather the useless information or to adopt an inadequate method of sampling.

The spread first of sampling, and then of more and more powerful methods of sampling, to new fields and new problems is going to mean a continuing increase in efficiency in operation. The immediate reduction in cost is important, but more important in the long run is the increased consciousness and consideration of the sources of error, with the consequent avoidance of overaccuracy where it does no good. This reduces cost still further. Still more important is the increased accuracy and usefulness of the information, for paradoxically enough the use of sampling generally improves accuracy in the long run.

The advances in sampling have been accompanied by advances in the art of improving and measuring the reliability of responses. Further growth in this art may be well-nigh as important in the next ten years as the growth in sampling has been in the last ten. From all these advances have come:

(1) Lowered costs per unit amount of information
(2) Greater speed
(3) Better quality of data (smaller errors in reporting, smaller bias from non-response, better control of the fluctuations of sampling).
(4) The ability to gear the cost or reliability of a survey pretty closely to the requirements.

All of these have increased the efficiency of the government statistical program substantially.

7. The appropriateness of figures

Coequal with the need of appreciation of the reliability of figures is the need of more consideration of the appropriateness of figures. To what extent does this series measure what its name implies, or what should be measured for the purposes to which it will be put? Much progress has been made in a few areas toward measuring the correct thing, much more remains to be done. This one reason why broader information about the definitions of statistical series is important.

The competent statistician is always aware of the errors of his measurement. Be he psychological tester or area sampler, he is always impelled to choose the quantity he can measure most accurately, whether or not it is the most useful quantity. The test-user is impelled to use a reliable test in a difficult area rather than a valid one. The area sampler is impelled to make an election poll by accurately sampling the registered voters rather than to try the hard task of sampling those who will go to the polls. Fortunately, most competent statisticians are aware of these tendencies and are quite successful in fighting them.

This problem will remain a central one for statisticians as long as the profession lasts. It is not an easy problem, nor is it comfortable to work on it. A well-designed sampling plan produces, with relatively little work, a reliable estimate of its own reliability. This estimate can be written down with the feeling of a job well done. For the present and the immediate future, there is no equivalent process for producing a reliable estimate of the validity of the estimate.

With all this difficulty, these problems must be met. Though it would be simpler to have merely to carry out a reporting function on some measuure where accuracy is easy, the responsibility of the statistician is to prove useful bases for decision, and this includes some responsibility for the choice of the correct bases.

II
The Reporting Function

8. In general

If we try to separate the functions of auditing and cost accounting, we find that auditing is intended to ensure that no funds have been diverted, while cost accounting tries to determine to what causes the expenses were due, to what purposes they were used. This latter information is clearly statistical information intended to serve a reporting function. The arbitrary procedures by which costs are often allotted among different accounts are an evidence of the survival of an auditing approach in cost accounting. The function of

cost accounting is to produce fallible statistical information for reporting purposes, and this function is now more and more clearly recognized, as is the fact that exact information is unattainable.

Reporting information serves its purpose only as it guides decisions, whether to change the aim of the gun 5 mils to the right or to stop lathe #14 and make an adjustment for tool wear, or not to do one of these things. This purpose will be better served if there is a well-understood logical framework, whereby the effects of a 5 mil change of aim or a .005 inch change in tool position can be predicted in advance. It might be argued by some that such logical frameworks are infrequent in the economic and political problems of greatest concern to the federal government, and that, therefore, reporting information is of little value. This argument fails miserably on careful analysis, for these economic and political questions must be decided, and it is desirable that they be decided on the basis of the best information available. From his own knowledge, a Representative will find it very hard to estimate the number of unemployed among the 300,000 residents of his district. He might rely on information gathered together, perhaps by local supporters, perhaps by the government, perhaps otherwise, but he must rely on reporting information, even in such a simple matter concerning his own district.

It follows directly that reporting information must be timely. Today's decision cannot be guided by information which will be available next week or next month. The need of more timely reporting by federal agencies was stressed by several members of the American Statistical Association who use federal statistics in business. One way to provide more timely values of government statistical series is outlined in the following recommendation.

> RECOMMENDATION 1. Study should be given to increasing the timeliness of various federal statistical series by
>
> (i) greater use of sampling (thus providing results which may be subject to somewhat larger errors),
>
> (ii) further study of methods for forecasting results from early or partial returns,
>
> (iii) more use of early tentative figures followed by later corrected values.
>
> After study and consideration within the agency, such changes should be discussed by a mixed committee of government producers and users, non-government users, and, if possible, neutral experts. To make efficient use of such advance values easier and more frequent, consideration should be given to
>
> (iv) issuing a weekly bulletin of advance statistical releases, prepared by planography or other quick process and replacing separate releases on separate series.

The matter of timeliness is one of very considerable importance.

The importance of reporting and analysis information in business was recently emphasized by General Brehon Somervell, war-time head of the Army Service Forces and now president of the Koppers Company, in a speech before the American Management Association on June 9 of this year. He is an enthusiastic supporter of control sections in industrial organization which "act as the eyes and ears for the chief executive of the company or an operating division". The scope of such a section usually includes the reporting function and much of the analysis function, and other functions of an organizational rather than statistical nature.

Since reporting information is to be used to indicate the actual results of operations and as a basis for decisions concerning future operations, it is desirable that it be collected and summarized by a group independent of the main operating organization, *insofar as this is reasonable*. In any case, the reporting group should be free to report what it finds, uncolored and unmodified! There are many exceptions where independence is not advisable, in government as in other organizations. Just as the Board of Directors usually accepts the Treasurer's figures, it would usually be unwise for Congress to set up a *complete* parallel agency to provide it with reporting information. Noting the existence of these exceptions does not reduce the importance of independence wherever reasonable. For the same reasons, it would seem reasonable if reporting information were handled by a group reporting quite directly to the administrator, executive or manager who will use the information as a basis for decision. Where the same reporting information guides the decisions of many persons, as is often the case, there may be no advantage in staff level organization.

9. In an operating agency

From a statistical point-of-view it is natural and convenient to divide the agencies of the federal government concerned in any way with statistics into operating agencies and statistical agencies. Statistical agencies, like the Bureaus of the Census and of Agricultural Economics, are primarily concerned with the gathering or preparation of statistical information, or with both. Their *operations* are the handling of figures. In contrast to this an operating agency does something else, and has an interest in statistics only incidental to its main function, whether this be engineering, carrying the mails, or regulating interstate commerce. The problems of statistical organization and of the handling of statistical data are very different in the two kinds of agency.

In the operating agency, if control information is being provided, in the first instance, for the administrator, then a control section, under some name, may be often the logical form of organization, reporting as directly as possible to this administrator. If the information is being used by many, then some other organization may be logical.

It may very well be wise and efficient for an operating agency to collect information for other agencies, either in the course of its operations, or on subjects about which its employees are particularly well informed. Cooperation is a first essential in this respect, and in Washington seems to have been the rule rather than the exception. The opinion of those with experi-

ence in the matter seems to be that such information should often be transferred as soon as possible, perhaps in a very crude state, to the agency wishing to use it, since the pressure of operations is likely to prevent the collecting agency from giving the information as much careful attention as it warrants.

For similar reasons, though an operating agency may be the proper collector of information whose ultimate use is outside the federal government, it will often be desirable to transfer such information to a statistical agency for preparation for release.

10. In a department

In a large department, where much control information is needed for governmental and non-governmental users, it may be appropriate to have a separate agency whose main function is statistical. The Bureau of Agricultural Economics is one such. Part of the function of such an agency is supplying reporting information for the Secretary's office, the President, the Congress, state and local governments, business and industry (farming is either a business or an industry as you please—farmers are among the important users of the statistics prepared by the Bureau of Agricultural Economics). Organization as a separate agency provides the independence and direct contact with the executive which is appropriate for a control section serving the Secretary of the department and his assistants.

As was emphasized earlier, it is often wise, efficient and natural to transfer information collected by some peculiarly appropriate operating agency to such a statistical agency while in a very raw state.

It is perhaps appropriate to point out here that in performing two different reporting functions, two different agencies may provide statistical series labelled "Construction" or "Unemployment", both of which are really needed and used, each suitable for its own purpose. While it is always worthwhile to see if there is undue duplication, it seems clear that such duplication is far less frequent than would be supposed by comparing names alone. In many cases, such apparent duplication arises from differences in Congressional action in passing laws in differing but related fields. The cry of "duplication" is always tempting, and sometimes right, but it usually requires careful work by well-informed experts to determine its presence or absence. A certain small amount of duplication is wise and efficient as a means of comparing different methods and techniques. Gaps in the federal statistical program cause more inefficiency today than does duplication.

11. For the President

The President needs to know how the country is running, and how the Executive Branch is operating, both as a whole, and department by department. To do this he requires reporting information. To one without experience in the organization of the executive branch, it is not clear that efficient and adequate mechanisms exist to provide him directly with such information. They may exist within the Bureau of the Budget, and they may not. It seems possible that the *efficient use* of statistics in the Executive Branch might be substantially increased by providing the President with a relatively small control section, reporting in the Executive Office of the President. Such a group would depend on agency and departmental groups handling control information and on statistical agencies to do most of the work in connection with the information it handles, applying only the final touches itself.

RECOMMENDATION 2. The president should be provided with a small, professional group to furnish reporting and analytic information.

12. For the Congress

Just as the President needs a control group, so does the Congress. It may be that the Legislative Reference Service in the Library of Congress is beginning to play this role, but it seems doubtful that there is an adequate group trained and adept in the handling of figures.

RECOMMENDATION 3. The Congress should be provided with a small, professional group to furnish reporting and analytic information.

13. For state and local governments and the private user

It would not be appropriate to set up complete control sections for such users in the federal government. They exist already in many cases in state and local governments, in trade associations, and in some large businesses, etc. The most that is appropriate here is to enable the user to reach the statistics already gathered by the federal government, whether for internal or external use, quickly, easily and effectively. There is a large problem in communication to be solved here which will take many steps over many years.

A first essential is that the reporting information provided be clearly defined. It is not enough that "In the text of a federal bulletin you find the same numbers in horizontal order that stand in the tables in vertical order!" There must be an adequate description with the figures, and a very thorough description should be on permanent file, available for use now and in the future.

RECOMMENDATION 4. All government statistical releases should be accompanied by accurate and clear descriptions of what is measured or counted. Where the accuracy is known or can be estimated, it should be given.

Even if the figures are accurately described, they are no use if they are never found. One member of the American Statistical Association, who has been and is very well acquainted with the government statistical program writes: "Recently, in doing a survey on the American market for Jute products, I secured valuable information, as I recall, from ten different Government agencies." Such experiences underscore the recurrent suggestion of a centralized overall index of government statistical information, supplemented by a central library or display place. If the statistical program of the federal government is going to fulfill one

of its main purposes efficiently and effectively, and is going to provide reporting information for the distributed management of the businesses, industries and other activities of the United States, such central index (a card file, not a publication!) seems essential and to be strongly recommended.

RECOMMENDATION 5.

(i) A centralized index of government statistical information, published and unpublished, should be established.

(ii) It should be supplemented by an open library (for display and consultation, not for circulation) containing the more generally used information.

(iii) Information which is to be printed should be furnished the library (with the exception of timed release material, such as crop reports) not later than when copy is sent to the printer.

The problem of collaboration between 1 federal, 48 states, three thousand-odd county and many local governments in the gathering of statistics is important and deserves more attention than it has received. Such attention will have to be given cooperatively by the various governments and by non-governmental users.

RECOMMENDATION 6. Three important and diverse fields of possible overlapping between federal and state statistics should be selected, and three separate committees representing interested parties with the addition of neutral experts should be appointed and directed to study the possibilities of improvement (one such field *might be* Unemployment Statistics by States).

There has been a feeling in certain trade associations that certain statistics now collected by the government could better be collected by the trade association. If the individual businesses involved were all *quite willing* to turn over the necessary information to the trade association, it is clear that the reporting function within the trade would be performed at less cost to the federal government. Another question is the extent to which such reporting information is needed by other users, inside or outside of the federal government. Their interests might not be satisfied by the collection of reporting information by an organization wholly outside their control. One solution for such problems would be to let the trade association collect information on a complete count (auditing) basis and to supplement this by government surveys of a somewhat different sort on a sampling basis. This seems worthy of investigation.

RECOMMENDATION 7. The gathering of "complete" information by trade associations, supplemented by government sample surveys, should be considered in a few suitable areas, and, if found reasonable, tried.

14. Needs

If the reporting function of federal government statistics is to be performed more effectively and efficiently, there are several general things which should be done.

1. The use of modern methods of sampling. and, where appropriate, of question construction, should be encouraged.
2. The present informal cooperation between statisticians in different agencies and departments should be strengthnd and encouraged.
3. The organization at the higher levels should be such as to ensure adequate numerical information for the policy-maker.

Recommendations bearing on 3 have already been made as regards the President and the Congress, and on 1 as regards the Bureau of the Budget. As regards 2 there are the following recommendations to be made:

RECOMMENDATION 8. The government should continue to encourage informal contact and participation in professional societies by its statisticians, including the paying of traveling expenses to relevant meetings, in the well-founded expectation that the ultimate savings will be many times the cost.

RECOMMENDATION 9. Where neutral experts are members of advisory committees, the government should turn the selection of such experts over to a suitable professional (non-governmental) organization and then pay their traveling expenses and adequate compensation, so that these experts may be truly neutral.

III
The Analytical Function

15. Relation to the reporting function

It is time again to make the distinction between the reporting function and the analytical function. The process of gathering numerical information about a predetermined and clearly defined subject, sometimes to predetermined accuracy, is the reporting function. Interpreting this information, seeking new information on the spot, or planning what information should be systematically collected in the future, is analysis.

Clearly each of these functions supports and is necessary to the other. But it is worth while to distinguish them since the personnel and the techniques involved are often different, as is the placing in the organization. Without reporting, analysis would not have the information to interpret, and without analysis, there would be no way of deciding what reporting information to collect. When separated, analysis and reporting *must* keep in close touch, both in detail and in the large.

Sometimes the analytical problem can be solved once for all (that is, for a very long time) and the routine use of the information then becomes a reporting function. The simplest examples are in the inspection of industrial production, where analytical study has determined the acceptable number of defectives in a sample of fixed size, and all that remains is to count the number of defectives, and accept or reject the lot accordingly. The opposite situation might occur in an intensive preliminary survey of public opinion with open-ended questions, where the whole analysis of the results, including the individual attitudes analyzed and the categories used would be determined after the answers had been collected. The reporting function is nearly absent from this latter example. To see both functions in either of these examples we must look at the situation over a long enough time. Generally the situation is not so extreme.

The purpose of gathering numerical information is to affect decisions by administrators or policy-makers inside or outside the government in the near or distant future. These decisions can affect only that which comes after them, and so the numerical information must bear on "what would happen if". The reporting function reports on "what was the case", and the analytical function must indicate the significance of this for the future. Numerical information is useless without interpretation.

Even when all are agreed on the facts there are every day many conflicts in interpretation. This situation often makes the analytical function difficult, for its interpretations are always subject to question. Yet they must be made before the information is usable. In simple cases the ultimate user, be he administrator, presidential assistant, congressman, sales manager, or voter, can do his own analysis. But the situation is frequently quite complex, and some specialist must do at least part of the analysis. In such a case it is the specialist's responsibility to provide:

(1) his interpretations
(2) the principles by which they are made
(3) the numerical information on which they are based.

RECOMMENDATION 10. Wherever politically feasible, it is appropriate to supplement government numerical information with interpretation, *provided* the principles of interpretation and the original numerical information are made clear.

There is another and occasionally very important field where analysis and reporting intergrade. This is the problem of setting up control procedures in a new field. Here there are no standard forms of questions to guide the routine reporting statistician or routine analyst, and judgment in selecting questions and taking advice bears an unusual premium. The first stages of such an operation as the War Production Board did not merely resemble the first stages of the operations analysis of combat air forces, they were essentially alike in the high and unusual skills required. The ability to enter a new field intelligently and rapidly characterizes one of the rarer types of analyst, who will always be at a premium during a national emergency.

16. In general

The personnel needed to do analysis is clearly varied, depending on the complexity of the problem and the nature of the subject matter. In simple cases, as noted above, it will be done by the user himself, working directly from the reporting information. In more complicated cases there may be required an economist, a statistician, or an expert in the start and spread of epidemics. Any expert analyst uses more or less statistics, and profits from his statistical knowledge, be it great or small. But this is no reason to say that all analysts should be statisticians, far from it. Where there are many individual analysts, each working on his own problems, there is surely a place for a statistical consultant. Where there is a group of analysts working on a single problem there is usually a place for one or more statisticians in the group. In some areas, in fact, the whole group may well be statisticians. In summary, analysis requires experts in many fields, with a liberal sprinkling of statisticians, and the spreading of larger or smaller amounts of statistical understanding and technique to all.

A basic problem which the analytical function has in common with many functions of scientific research is a simple, general and difficult problem of organization. In general, our industrial, business and governmental organizations give preferment, whether in pay, rank, or quality of office space, in terms of extent of administration or management. Similarly, the rank of an officer in the armed services is determined largely by the number of men he commands. This principle caused difficulty during the last war in various military research establishments, for example during the militarization of the Naval Research Laboratory where a decision that there "just couldn't be so many officers and so few men" caused ex-civilians to be outranked by officers who had been effectively their subordinates, with a corresponding loss in efficiency. Similarly, a well-planned analytical group will have relatively few members without P-ratings, and the average P-rating of the group will be unusually high. These ratings will have been assigned for technical abilities and responsibilities, in work mostly carried out by the analyst himself, and not by others.

Like a highly expert chemist, the expert analyst is to be judged by what he does rather than by how and what he tells others to do. This situation will be aggravated by the trend to greater and more complex mechanization of statistical work. It will take a different type of expert to supervise a new electronic computing machine, and it will be less wise to place him "under" the analyst on the organization chart than it is to put the supervisor of computing clerks there today. Careful study of this problem is to be recommended.

RECOMMENDATION 11. Civil service recognition should be given to the technical skill and responsibility of analysts, whether statisticians or not, as a substitute for administrative responsibility.

There can be technical responsibility of equal importance to administrative responsibility.

The need for the analytical function seems always to be recognized slowly—often far too slowly—and it is almost certain that the efficiency of the federal statistical program, measured as it should be in terms of sound bases used for decision, would be improved by adding analytical groups and increasing the scope and opportunities of some of those which now exist. Detailed recommendations would require detailed knowledge which the writer does not possess.

RECOMMENDATION 12. The number and scope of the small, highly professional analytical groups in the federal government should be increased.

17. In an agency

While the analytical group is performing its major function of assessing the quality and meaning of the numerical information with which it is supplied, or which it discovers, and in sending the results to the user, it provides a further essential link in the overall chain. For from the analytical group, particularly the analytical group with an adequate sprinkling of statisticians, comes a steady pressure for numerical information of the correct sort and the correct accuracy. By this emphasis on the correct accuracy, which usually comes from the statisticians, and by this alone, can the federal statistical program be kept in balance for each individual item. Either too much accuracy, or too little, is inefficient or perhaps even dangerous, and it is the "feedback" from analytical groups on which we must depend for proper balance.

18. For the President

The control group for the President suggested above would have analytical as well as reporting functions. There is, of course, a top-level analytic agency already in existence in the Council of Economic Advisors. They should be exempt from handling more routine problems, because of the importance and difficulty of their main task.

19. For Congress

Similarly, a control group for Congress would provide analysis as well as raw numbers. Apparently some of this work is being done by the Legislative Reference Service and more by the staffs of committees, particularly the Joint Committee on the Economic Report, but it seems doubtful if the scope is yet wide and deep enough.

20. For other users

The analysis for users outside the federal government is mostly decentralized, and this seems appropriate and justified. The various government agencies do some analysis of the information which they publish, and it seems likely that they do too little for efficiency rather than too much, since more analysis would provide better guides to the needed accuracy of the basic information.

Cooperation and the ready flow of information between these dispersed analytical groups and the various government agencies is of the highest importance. It is only through such cooperation that the right information will be collected with the right accuracy. It is the writer's impression that the various advisory committees do a very satisfactory job in presenting the more obvious users of the most classes of information. The best way to supplement these committees is through the activities of professional societies, such as the American Statistical Association. There seems to be a real need for strengthening professional activity in this area through committees and meetings.

For the voter, there is a need for clearer and far more complete information concerning economic affairs. Of a dollar spent for an automobile, how much goes for labor? We hear that such-and-such a percentage of the manufacturer's expense goes for labor, but we need to know how much of the rest goes for labor in coal mines, steel mills, parts factories, and dealers. The voter, as an ultimate user of statistical information and as the ultimate policy-maker, has not been given the information he needs in the terms which he understands. This is a serious lack of efficiency in the statistical program of the federal government, since it results in the ultimate policy-maker's basing decisions on unnecessarily inadequate information.

It is not being claimed here that such information is easy to get. There may be no one today who can actually break up the automobile dollar with any degree of accuracy using figures now available. It may require new techniques in many places to get these figures, but the results would be worth the trouble and expense. This is an important recommendation.

RECOMMENDATION 13. The citizens should be furnished numerical information on economic matters in terms which can be readily understood, even if this information is hard to get.

21. Needs

One thing the analytical function needs is more trained analysts, particularly with statistical training. The personnel problem will be discussed in Chapter VI.

Next, the analytical function needs new techniques, which will have to be provided by research, which is discussed in Chapter V.

IV
The Consultant Function

22. Relation to reporting and analysis

The consultant is concerned with the design and analysis of experiments, surveys, and investigations. Some of these will be biological, some chemical, and so on. Most prominently some will be statistical in the sense that they arise in connection with the reporting or analytic functions. A survey of crop acreage, or of indicated yield per acre is almost certainly a statistical survey rather than a biological one, since its aim is to provide farmers and others with information about the probable crop this year. On the other hand, a measurement of the yield on experimental plots is a biological experiment.

These statistical surveys and investigations are today almost certain to involve sampling. Those who do their detailed planning and supervise their conduct are going to have some knowledge of sampling, but their knowledge is going to be limited. There are nowhere near enough sampling experts to go around, and there are not going to be in the predictable future. The statistical consultants must furnish the deeper knowledge of sampling, both in theory and in practise. He must know about the various new advances which are still coming quite rapidly, and must be prepared

to twist old techniques into new ones when the situation demands it. He is responsible for the efficiency of the statistical technique in the field and in the computing room.

For the analyst, who is likely not to be a professional statistician, he will also have to provide knowledge of, and experience in using, varied methods of analyzing data, some old and some new, some complex and some simple. It is his responsibility to help the analysts to answer their questions as thoroughly and accurately as possible with the least trouble.

Where reporting operates from a fixed doctrine (received from analysis) as is the case in inspection, it is the consultant who provides guidance in more efficient ways of meeting the doctrine, as for example by proposing a more efficient sampling plan.

The consultant is the channel through which the modern developments in statistics have spread throughout the government statistical program. The credit for the increase in efficiency must be shared between the many users of the new methods and the few consultants, but the gain in efficiency would never have come if the consultants had not been there. Their invisible exports have been, and will continue to be, of the utmost importance to the government statistical program. The influx of improved statistical methods has just begun. Methods now used here and there will become widespread and new methods will appear. These improvements will come through the consultants.

23. Relation to Experiment

For the present and predictable future, the planned experiments of the federal government are outside the fields of economics, politics and sociology. Many things which the government does could be thought of as experiments in this field, but they are not planned to find out the effect of the change. Rather they are hopefully planned to improve the situation. They are trial operations rather than experiments. The experiments on which the consultant advises, then, are usually in the physical or biological sciences or in their applications.

The earliest field of experiment into which statistics and the statistical consultant came to play an important part was agriculture. This was natural because decisions between varieties, and between fertilizer treatments, had to be made every year and had to be made accurately. Yet the interfering factors—weather, changing from year to year and from place to place; fertility differences; weeds; and many others—made accurate measurements very difficult. The hopeful and simplifying techniques of the laboratory experiment would not apply, since the wheat plant grows differently in a field than in a pot, differently in a normally plowed field than in a plot where the soil is uniform to a depth of three feet. Modern agricultural experimentation would be impossible without advanced statistical techniques, and with any conceivable amount of effort we could not be so far advanced as we now are without its use. Consequently, agricultural experimenters know more statistics, and can use more statistical techniques without guidance, than those in any other field. The place of the consultant in agricultural experiment has grown more important rather than less, and this may be a sign of what is to come in other fields.

In medical research the complexities are often at least as bad as they are in agriculture. For one reason or another the introduction of statistical methods into medical research is about 25 years behind its introduction in agriculture. This gap is narrowing steadily, and the consultant here has rapidly increasing importance.

In physics and chemistry the "old" methods were good enough for a long time, but modern statistical methods are now spreading, chiefly through consultants, at a great rate.

The major importance of the consultant in scientific experiment is in economy of the scientific potential of the country. We have a limited supply of scientists, who can do only so much science per year. Much science is being done in the federal government, or under contract to it, and it seems clear that more will be done tomorrow. Inefficiency and waste in the use of scientific manpower is at least as serious as inefficiency and waste in spending money, and is probably far more serious. One way to reduce such inefficiency and waste is to furnish statistical consultation to these scientists.

The federal government, particularly through its military programs, is carrying on a substantial amount of that sort of engineering development which involves experiment. The place of statistics and of consultants is the same here as in the physical sciences.

24. In an agency

If a statistical consultant is to be really useful, he should be closely related to the working group. The main load of consulting must be carried by a man in this part of that agency, another in that part of this agency, and so on. Today, perhaps, the shortage of consulting personnel may be so acute that a single man will have to be in several places, perhaps, on different days of the week, but he should have a spot in the organization at each place. Effective consultation is at close range.

There is a place for a few independent groups of general consultants, who draw problems from and supply advice to a broad area. Just as local consultants usually do analysis, so general consultants normally do a considerable amount of local consulting and some analysis. Ideally, general consultants should be drawn into a problem through the local consultants, who are reasonably likely to recognize a problem when they see one. Today they often may work directly, since the local consultant may not exist. The number of groups is not particularly important, since their contacts

through informal and professional channels will be frequent and thorough. Perhaps today it might be reasonable to have three such groups, one concerned with sampling and surveys, one with the physical sciences and engineering, one with biological problems. Or the last two might perfectly well be combined. Whether such a group is in the Bureau of X or the Bureau of Y is unimportant. What matters is the freedom with which problems from any bureau come in by telephone or in conference. (The newly-founded Statistical Engineering Laboratory of the Bureau of Standards is a fine start on the group in physical sciences and engineering and a useful addition to the groups already in existence.)

RECOMMENDATION 14. Consultants should be dispersed through the various agencies. and these local consultants should be supported by two or three groups of general consultants.

25. At higher levels

Until and unless the federal government goes in for planned large-scale experiments, there is no need for consultants at levels above the agency. Coordination between agencies will take place through informal and professional channels.

26. Needs

The needs of an adequate and efficient consultant function are easy to state. They are:

(1) personnel who can consult, and

(2) organization which will favor consultation.

The problem of personnel will be discussed in Chapter VI, and is probably the most serious one for the consultant function.

What is the organization which will favor consultation? One aspect of this has already been discussed—the consultant must have a close relation to the working group. The real problem is this: How much authority should the consultant have to examine, discuss and comment on the work, whether the workers favor this or not. Apparently the experience in the federal government has been that, when the consultant has the patience and diplomacy such a position requires, the more authority to enter problems and comment on them the better. Since this seems to agree with experience elsewhere, it merits recommendation.

RECOMMENDATION 15. Local consultants should have as wide authority as will not cause serious friction, to enter and comment on problems.

This will, of course, tend to place the consultant in an independent branch of the agency, or on the director's staff. It will require, occasionally, support for the consultant from high levels.

Chapters V-VII will appear in the April issue

NEWS

CONTINUED FROM PAGE 3

Soviet Statistics shifted from Planning Body to Council of Ministers

The New York Times of December 14, 1948, reported that the Soviet Central Statistical Administration has been removed from the control of the State Planning Commission and placed directly under the Council of Ministers. According to the *New York Times:*

"A clue to the reason for the change is given in a series of statements over the last two years in Soviet economic reports that have emphasized that 'wholly new' problems in economic planning have been presented to Soviet economists and statisticians.

"In the latest of these Academician S. G. Strumilin, veteran Soviet economist, urged at a session of the Institute of Economics of the Soviet Academy of Sciences that a statistical research institute be established.

"An anonymous commentator in Voprosy Ekonomika, Soviet economic journal, hinted at the nature of the problems when he wrote:

" 'The theoretical working out of problems of economic statistics strongly lags behind the ever growing demands of the practice of socialist construction. At the present time, when the demands presented to statisticians in connection with the solution of tasks of the post-war five-year plan become all the more complicated, the backwardness of statistical theory is becoming unendurable.'

"The change in affiliation of the Central Statistical Administration represents not a rebuke to that administration but an increase in its importance in the Soviet governmental structure, American experts on the Soviet Government said when they were informed about it.

"The Central Statistical Administration not only prepares the data on which the annual plans and the five-year plan are formulated, but is the 'watchdog' of the plan, they pointed out. Possibly in making the shift the Soviet Government wishes to have the agency responsible for reporting on the actual situation responsible to the highest governmental organ, the Council of Ministers, rather than to the planning authorities."

American Society for Testing Materials symposium published

The "Symposium on Usefulness and Limitations of Samples", published by the American Society for Testing Materials, contains the three following technical papers:
Sampling and Its Uncertainties, by Samuel S. Wilks, Professor of Mathematical Statistics, Princeton University;
On Variations in Materials, Testing and Sample Sizes, by Leslie E. Simon, Colonel, Ordnance Dept., Director, Ballistic Research Labs., Abereden;
The Amount of Inspection as a Function of Control of Quality, by G. R. Gause, Bell Telephone Labortories.
Copies of this 40-page booklet can be obtained from the American Society for Testing Materials Headquarters, 1916 Race Street, Philadelphia 3, Pa., at $1.00 per copy.

Lotteries and Pools

by ERNEST BLANCH
Chief Statistician
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The lottery is almost as old as Christianity. When it made its first appearance in Roman times, it was a simple harmless pastime. In those days everyone who participated in a lottery received a prize.

The first commercial lotteries appeared in the early 1400's in Belgium. The Italians became lottery-conscious early in the sixteenth century. France and England adopted the lottery shortly thereafter. When Queen Elizabeth sponsored the first English lottery in 1569, the rules of the drawing provided, as in Roman times, that each person who bought a ticket was entitled to a prize. Tickets sold for ten shillings (about $2.50), and the value of the prizes ranged from fifty cents to $25,000. The profits were reportedly applied to public works projects.

As the years went by, the gentlemen of the professional gambling fraternity gradually began to dominate lotteries, and, inevitably, fewer and fewer persons received fewer and fewer prizes. By 1697 lotteries were run with only four percent of the money involved going back to the participants.

It is interesting to note parenthetically that lotteries were often used in seventeenth century England to dispose of personal property which could not be easily sold. It was not uncommon for a ship owner, for instance, to raffle off his vessel. If he were granted permission by the government, he could sell tickets and hold a drawing to determine the winner. Antiques and works of art were frequently marketed in this manner.

However, improper use of lotteries finally compelled England to abolish lotteries in 1826.

Along with other European products, the lottery was imported into the American colonies under uncertain circumstances. It is, however, a matter of record that, by 1760, many civic, fraternal and religious organizations conducted lotteries for seemingly worthy purposes.

Columbia University's predecessor, King's College, was originally financed largely by a lottery. Harvard, Yale, Dartmouth, and other leading institutions of learning also benefited by this financing technique.

"Lotteries and Pools" is part of a book *You Can't Win (Facts and Fallacies about Gambling)*, to be published by Public Affairs Press, Washington, D. C., in March, 1949.

During the Revolutionary War the Continental Congress authorized a national lottery for the purpose of raising some ten million dollars. However, this lottery was unsuccessful and it was discreetly called off.

In the early 1800's, the lottery achieved considerable popularity. In 1832, according to the Boston *Mercantile Journal*, approximately 420 lotteries were drawn in eight states (New York, Virginia, Connecticut, Rhode Island, Pennsylvania, Delaware, North Carolina, and Maryland). The total sum paid for tickets in these lotteries—66 million dollars—was five times the expenses of the federal government for that year.

Interestingly enough, when Thomas Jefferson found himself with a huge debt at the age of 83, after having served eight years as the nation's president, the Virginia legislature in 1826 authorized him to dispose of some of his real estate by lottery. However, the scheme was abandoned after Jefferson's death a few months later.

Gradually, sharpers and cheats began to take over the lotteries. Fraudulent practices and lawlessness became widespread. The public and the press soon began to protest vigorously. The situation was so serious that New York State found it necessary to pass a law requiring each seller of lottery tickets to pay a licensing fee of $250 a year. This apparently failed to have the desired cleansing effect and by 1834 the lottery was illegal in that state and has been ever since.

Other states followed New York's example. By 1840 Pennsylvania, Ohio, Vermont, Maine, Massachusetts, New Jersey, New Hampshire, Illinois, Louisiana, and Virginia had prohibited lotteries.

The Southern states continued to tolerate lotteries on a small scale and after the Civil War they endeavored to use them as a means of raising public funds. But popular indignation arose and lotteries came to an end.

In 1890 Congress passed a law forbidding the distribution of lottery material and tickets through the mails. In 1895 it forbade interstate transportation of lottery tickets, and this virtually sounded the lottery's death knell in this country.

• • •

Despite its respectable beginnings and frequently worthy purposes, the lottery is a gambling device—seldom pure and rarely simple. Of necessity, present-day operators of lotteries in this country conduct

their affairs surreptitiously, distributing their tickets through "runners" with shady pasts and questionable futures.

It isn't generally realized that most of the tickets for foreign lotteries being sold in the United States are counterfeit and that only a small percentage of the money which does find its way to the lottery sponsor goes back to the ticket holders in prizes.

Of the legitimate foreign lotteries for which tickets are sold in the United States, the most widely known is that of the Irish Sweepstakes. Innumerable Irish Sweepstakes tickets—usually priced at $2.50—are sold in this country each year. The prizes—ranging as high as $100,000 and $200,000—are based upon the results of a designated European horse race.

A great deal of fanfare follows announcement of the winners, but no one salutes the losers, of whom there are millions. The percentage of the total income actually paid to winners in the Irish Sweepstakes is a carefully guarded secret, but those in the know believe it to be quite small.

One of the most affluent gambling rings in the country capitalizes on the general interest in sports through a lottery, using numbers to represent the respective teams in four of the country's major baseball leagues—American, National, International, and American Association. Since there are eight teams in each league, the numbers in the lottery run from 1 to 32, as indicated in the following table:

AMERICAN	INTERNATIONAL
1. New York	17. Jersey City
2. Washington	18. Buffalo
3. Boston	19. Montreal
4. Cleveland	20. Newark
5. Philadelphia	21. Baltimore
6. Detroit	22. Syracuse
7. St. Louis	23. Rochester
8. Chicago	24. Toronto
NATIONAL	**AMERICAN ASS'N**
9. New York	25. Milwaukee
10. Pittsburgh	26. Columbus
11. Philadelphia	27. Kansas City
12. Cincinnati	28. Minneapolis
13. Boston	29. St. Paul
14. St. Louis	30. Indianapolis
15. Brooklyn	31. Toledo
16. Chicago	32. Louisville

The tickets in this lottery are sold at twenty-five cents and selected at random by the purchaser. Each contains four numbers designating the four baseball teams. The scores of the teams determine whether or not the ticket wins.

The prizes offered by the operators are as follows:

For each of the six week-days: daily high total, $100; second high, $25; daily low total, $100; second low, $25.

For the week: high total, $500; second high, $200; third high, $100; low total, $500; second low, $200; third low, $100.

No skill is involved since the selection of the ticket is made at random and no opportunity is given to the player to rate the contending teams. The fact that the total baseball scores determine the winners is not significant. The winning tickets could have been determined by some other method—for example, the number of errors, or the number of hits, or, in the least complicated manner, the selection of numbers out of a hat.

Mathematically, the number of different combinations of four teams selected from 32 is 35,960—which means that the holder of a single ticket has one chance in 35,960 of winning the weekly high prize of $500. (In the event that the baseball scores are such that two persons have equal high totals, the $500 prize is divided evenly.)

The gambling ring conducting this lottery collects a total of $8,990 each week (35,960 tickets at 25c each), out of which it pays a total of $3,100 in prize money. Thus the operators make a profit of $5,890 each week—about 66 percent of all the money wagered!

Variations of this lottery return even less to the gullible public. One gambling syndicate is increasing its profits by issuing tickets with five teams instead of four. The addition of the fifth team to the group raises the total number of different combinations to 201,376—which is more than five times the number of lottery tickets involved when only four teams are used. The enterprising sponsors of this lottery sell their tickets at the bargain rate of five for a dollar. Their net "take" per lottery is $37,175.

A common lottery is the "football pool" conducted each Saturday when the college teams of the nation compete on the gridiron. Participants in this lottery are permitted to select their choices of any number from three to ten games. If a player picks three winning teams, he is paid at the rate of four to one.

However, the mathematical probability of selecting three winners is one chance in eight, assuming that there are no ties. If there is a tie game in the football lottery—the operator wins.

Since the football teams are not always evenly matched, the operators of the lottery employ a professional football handicapper to appraise the odds on each game. The superior team is handicapped by several or more points. Thus, one team is said to "spot" the other so many points. The handicap makes selection so difficult that about half the participants in the lottery select one team while the other half select the other—which is fine from the viewpoint of the operators.

In evenly matched games and those reduced to equality by means of a handicap, the probability that a team will win is one chance in two (assuming no ties possible) and any attempt to select three winners in three games is mathematically equivalent to $\frac{1}{8}$.

Since the operators pay only four to one (sometimes referred to as five for one), a dollar on each combination nets them a total of $8, out of which they return only $5 to the single winner. The $3 taken by the operators is equal to 37½ percent of the money wagered. If one of the games results in a tie, the operators pocket all the money.

A typical card distributed by the operators of a football lottery contains this sort of information:

ALL AMERICAN FOOTBALL SELECTIONS

1. Penn State		We Give	27. Ohio State	Spots
2. Pennsylvania	Even	or Take	28. Pittsburgh	13
3. Kentucky	Spots	the	29. Minnesota	Spots
4. Villanova	6	Spot	30. Purdue	13
5. Princeton	Spots	3 Teams	31. Northwestern	Spots
6. Harvard	6	5 for 1	32. Wisconsin	13
7. Missouri	Spots	4 Teams	33. Army	Spots
8. Oklahoma	6	10 for 1	34. Stanford	20
9. Texas	Spots	5 Teams	35. Cornell	Spots
10. Baylor	6	16 for 1	36. Colgate	20
11. Washington St.	Spots	6 Teams	37. Vanderbilt	Spots
12. Oregon St.	6	30 for 1	38. L. S. U.	20
13. Duke	Spots	7 Teams	39. Michigan St.	Spots
14. Wake Forest	6	40 for 1	40. Marquette	21
15. Dartmouth	Spots	8 Teams	41. Notre Dame	Spots
16. Columbia	7	75 for 1	42. Indiana	25
17. Arkansas	Spots	9 Teams	43. North Carolina U.	Spots
18. Rice	7	100 for 1	44. William & Mary	25
19. Oregon U.	Spots	10 Teams	45. California	Spots
20. Washington U.	7	200 for 1	46. U. C. L. A.	26
21. Illinois	Spots	9 out of 10	47. Georgia U.	Spots
22. Iowa	7	30 for 1	48. Florida	26
23 Georgia Tech	Spots	All Ties	49. Sou. Methodist	Spots
24. Tennessee	12	Lose	50. Texas A. & M.	26
25. Maryland	Spots		51. Michigan	Spots
26. South Carolina	13		52. Navy	28

You make as many selections as you desire. But the more winners you try to pick, the less chance you have of winning, and the greater is the operators' "take."

The following table indicates odds quoted by the operators as pay-off prices, compared with the mathematical odds. (No attempt is made to indicate the operators' additional advantage in the event of ties since there is no way to determine their mathematical probability.)

FOOTBALL POOL ODDS

No. of Games and Winners Selected	Pay-Off Odds	Mathematical Odds	Operator's Percentage Take
Three	4 to 1 (5 for 1)	7 to 1	37½ %
Four	9 to 1 (10 for 1)	15 to 1	37½ %
Five	15 to 1 (16 for 1)	31 to 1	50 %
Six	29 to 1 (30 for 1)	63 to 1	53 %
Seven	39 to 1 (40 for 1)	127 to 1	69 %
Eight	74 to 1 (75 for 1)	255 to 1	71 %
Nine	99 to 1 (100 for 1)	511 to 1	80 %
Ten	199 to 1 (200 for 1)	1,023 to 1	80 %
Nine Out of Ten	29 to 1 (30 for 1)	101 to 1	71 %

Of all the money wagered by players making three selections, the operator takes 37½ percent. Of the sum wagered by those with five selections, the operator gets 50 percent. Of the amount wagered by nine-selection players, 80 percent goes to the operators.

In the light of these percentages, one can easily understand why only a very small portion of the money invested in a lottery is distributed in the form of prizes.

Except for minor variations due to different times and customs, present-day lotteries are like their early European predecessors. Since the French Lottery, operated by the French Royal Government for many years but discontinued shortly after the Revolution of 1789, remains the basic pattern for lotteries still in operation, it is worth seeing how it worked.

In the French Lottery, the player bought a ticket for a fixed sum. He indicated a selection of one or more (up to five) numbers from the numbers 1 to 90. When all the tickets were sold, a drawing was held publicly and five numbers were drawn. If the player indicated one number and that number was one of the five drawn, he received a prize of 14 to 1. For a selection of two numbers, both of which were among the five drawn, the player received 269 to 1; for three numbers, 5,499 to 1; four numbers, 74,999 to 1; and five numbers, 999,999 to 1.

These pay-off figures may appear to be of astronomical proportions, but they are really less than the mathematical odds against winning. This is shown in the following table.

Note that the probability of selecting five winning numbers out of 90 is just one chance in 43,949,268! That is the number of different combinations of five numbers which can be drawn from 90 numbers.

Somewhat related to the French lottery is the present-day lottery employing five-digit numbers (ranging from 00000 to 99,999) and tickets selling at fifty cents a piece. After a number has been obtained from the daily Treasury balance figures or from some other

ODDS ON FRENCH LOTTERY

Numbers Matched	Probability of Occurrence	Mathematical Odds Against Winning	Pay-Off Odds
One	$\frac{5}{90}$	17 to 1	14 to 1
Two	$\frac{5}{90} \cdot \frac{4}{89}$	799 to 2	269 to 1
Three	$\frac{5}{90} \cdot \frac{4}{89} \cdot \frac{3}{88}$	11,747 to 1	5,499 to 1
Four	$\frac{5}{90} \cdot \frac{4}{89} \cdot \frac{3}{88} \cdot \frac{2}{87}$	511,037 to 1	74,999 to 1
Five	$\frac{5}{90} \cdot \frac{4}{89} \cdot \frac{3}{88} \cdot \frac{2}{87} \cdot \frac{1}{86}$	43,949,267 to 1	999,999 to 1

FIVE DIGIT LOTTERY

Match	Probability of Occurrence	Mathematical odds against winning	Pay-off odds
Last digit only	1 chance in 10	9 to 1	1 to 1
Last two digits	1 chance in 100	99 to 1	19 to 1
Last three digits	1 chance in 1,000	999 to 1	99 to 1
Last four digits	1 chance in 10,000	9,999 to 1	399 to 1
All five digits	1 chance in 100,000	99,999 to 1	1,999 to 1

public source, small prizes are awarded to those who hold numbers which have the same last digit, larger prizes to those whose numbers match the last two digits, still larger prizes to those who match the last three digits, grand prizes to those who match the last four digits and the highest prize to the individual whose number matches all of the digits in the same order.

Thus, if the winning number iss 21,497, all those whose numbers end in 7 receive $1 while those whose numbers end in 97 receive $10. Those with numbers ending in 497 win $50; those with numbers ending in 1,497 win $200; and the person holding the ticket reading 21,497 wins $1,000.

The above table shows how these pay-off prices compare with the probabilities of matching the respective sections of the winning number.

There are thousands of variations in the general lottery patterns mentioned above, and depending on the *modus operandi* and the "clientele," they net the operators somewhere between 40 and 90 percent of all the money paid by participants. Some greedy operators set up lotteries to return only two or three percent of the ticket money, and on occasion tickets are sold on lotteries which are never drawn, thus giving the operators 100 percent of the collection.

Besides the 40 to 90 percent mathematical disadvantage in most lotteries, there are incalculable possibilities for "fixed" drawings, counterfeit tickets, and unreported purchases. Possessing such mathematical and non-mathematical characteristics, the lottery is simply a money-making scheme for the operators. However, as long as people dream of winning fortunes, there will be customers for lottery tickets in spite of the improbability of winning.

You just can't win!

NEWS

CONTINUED FROM PAGE 17

First Statistical Yearbook of China

The first *Statistical Yearbook of China* is expected to come off the press soon. It will include chapters on: Geographical factors, political system, population, agriculture, forestry, fishery, livestock, water conservancy, minerals, industries, domestic and foreign commerce, land administration, food, finance, communications, education, health, social welfare, justice, civil service, and overseas Chinese. There will be over 300 tables, with text in Chinese of some 450,000 words.

Supplementary work is progressing on a compendium of statistical terminology in English and Chinese, with a list of 924 important statistical terms in English and their Chinese equivalents.

Handbook of Labor Statistics

The Bureau of Labor Statistics has announced publication of a handbook, including their BLS series from its beginning to 1948. The handbook is punched for loose-leaf binding and includes the series on Employment; Labor Turn-over; Earnings, Hours of Work, Wage Rates; Prices and Living Costs; Productivity and Unit Labor Costs; Strike Statistics; Industrial Injuries; Building and Construction; Housing and Rents; Consumer's Cooperatives, plus series on Social Security; Production; Income, and Expenditures.

Copies may be obtained from the Superintendent of Documents, Washington 25, D. C., for 75c each.

QUESTIONS and ANSWERS

edited by FREDERICK MOSTELLER

WHO ARE UNEMPLOYED?

Question 17. What is the difference between the Census Bureau concept of unemployment and the Bureau of Employment Security concept of insured unemployment?

Answer. The Census Bureau classifies persons as unemployed in the Monthly Report on the Labor Force provided they did not work at all for pay or profit during the survey week but were looking for work. Persons are considered as having looked for work if they made active efforts to find work during the survey week, or had made such efforts within two months and were awaiting results. Also included as unemployed are persons who would have been looking for work except that (1) they were temporarily ill, (2) they believed no employment was available in their line line of work or in the community, or (3) they were waiting to be called back to a job from which they had been laid off for an indefinite period. The definition of unemployment used in the 1940 census was substantially the same as that just outlined.

The Bureau of Employment Security count of insured unemployment represents continued claims filed for unemployment benefits or waiting-period credit under the unemployment benefit programs operated by the State employment security agencies, the Veterans Administration, and the Railroad Retirement Board. Initial claims are excluded since in general they merely indicate the beginning of a period of unemployment, while a continued claim certifies that a week of unemployment has been completed. Since the data are based on claims filed, they include some persons whose claims are subsequently disallowed. The continued claims are adjusted so as to represent a week of insured unemployment, rather than the week in which the claim was filed.

For a number of reasons the Census Bureau figures for unemployment and the Bureau of Employment Security figures for insured unemployment would be expected to differ. In the first place the Census Bureau estimates are based on a monthly enumeration of a sample of the entire population and, therefore, include all unemployed workers, whether covered by unemployment benefit programs or not. On the other hand, the Census Bureau definition of unemployment does not include several groups who might file claims under one of the unemployment benefit programs: (1) persons with jobs, but temporarily not working because of labor dispute, bad weather, or temporary lay-off with definite instructions to return to work within 30 days; (2) persons employed only part of the week, or receiving substantially less than their usual earnings because of reduced hours; (3) persons unemployed at their regular job during the entire week, but who picked up a few hours of casual work. It appears also that some workers who are registered at public employment offices as available for employment and who do not take any other active steps to find a job, may be reported in the Census survey as not looking for work.

Emmett H. Welch

NEW INDUSTRIAL CLASSIFICATIONS

Question 18. The Inter-Agency Technical Committee of the Federal government has promulgated preliminary classification codes of non-manufacturing industries as a continuation of the project which resulted in publication of Standard Industrial Classifications for manufacturing, prepared by the Technical Committee on Industrial Classification, Division of Statistical Standards, Bureau of the Budget, dated November, 1945.

In the proposed reclassification of non-manufacturing activities there seems to have been an avoidance of fourth digit numbers ending in "1" or third digit classifications ending in "1". In re-numbering certain groups of non-manufacturing activity, there has been a re-shuffling of numbers assigned in many instances where the content has not been changed. This rearrangement has mainly been one of rearrangement in numerical sequence within intermediate third digit groups, or a rearrangement within major groups, or finally, a numerical rearrangement of major groups and in too many significant cases without a change of content.

Since the assignment of numbers to logical groups of activities is more or less arbitrary, two questions are suggested:

(1) Considering the enormous expense which will be entailed by all agencies engaged in classification of economic activity who adhere to the new code, why were not the number of arbitrary changes, without change of content, kept at an irreducible minimum?

(2) What purpose is being served by the avoidance of fourth digit classification numbers ending in "1" or third digit classification numbers ending in "1"?

Answer. 1. It is an established policy of the Technical Committee on Standard Industrial Classification to keep all changes in process of revision of the classification at an irreducible minimum. Every effort is being made to follow this policy. It is important to note that the classification of non-manufacturing industries is still under consideration and therefore could not be, and was not promulgated.

2. Some operating agencies do not require detailed information on a four digit level, either throughout the classification, or for selected three digit groups. However, they use a four digit code in all instances where no further subdivision of a three digit group is made by adding the numeral "1" to the three digit group code. In order to meet requirements of agencies using four digit code for three digit groups not further subdivided, and requirements of agencies using four digit subdivisions of three digit groups, a device is being introduced to use number "1" for agencies "without subdivisions" and numbers from "2" to "9" for agencies "with subdivisions". It is necessary to add that the actual application of this device still remains subject to final approval by Technical Committee.

V. S. Kolesnikoff

NUMBER OF DIFFERENT KINDS OF ELEMENTS IN A POPULATION

Proposed Question A. The following question has been submitted to the Questions and Answers Column. The Editor would like to receive solutions or references relating to it.

A company has offered to give and has received requests for a free sample of its product. A large number of requests (say 100,000) have come in. These were filled. It is known that the same people often sent more than one request. From a sample of the requests how can we estimate how many *different* people have sent requests.

More generally, we have k classes of similar objects, with n_1 objects in class 1, n_2 in class 2, . . . n_k in class k. The class of an object is readily identifiable when the object is examined, but the classes are not ordered. We know $N=\sum n_i$. From a sample of size n drawn from the N objects, we wish to estimate k, the number of classes on the basis of the information given in the sample.

For the specific practical problem of the company giving free samples, we might take a sample of requests and then inquire of those whose names are on the cards, how many requests each had sent. We would probably find that some people had sent in cards for their sons and daughters and their spouses while intending to use the sample themselves. Consequently, even a complete study of all requests without personal interviews might not reveal the number of different people actually reached. However, with direct interrogation of those requesting, some progress might be made on this problem. Interviewing personally those requesting the samples—including follow-ups to the source of the request when the person whose name was sent in was not the person actually requesting the sample—would probably be very informative for the company giving the samples.

When we view the matter as a problem of balls in an urn, we have no one to interview. In this case it is necessary to take a sample, and on the basis of population size and the sample which gives the number of say white balls, red balls, beige balls, etc., we are required to estimate how many different colors are present in the population.

One might consider using the naive estimate

$$k_p = \frac{Nk_s}{n}$$

where k_p is the estimate for the population, N the size of the population, k_s the number of classes observed in the sample, and n the sample size. Suppose we have a population of $N = 10$ composed of $k = 5$ classes of 2 elements each. Let us take a sample size of $n = 3$ from the 10 objects. Then we will observe 2 kinds of elements 1/3 of the time and 3 kinds of elements 2/3 of the time, and these are our only possibilities. The naive formula estimates $k_p = 6\ 2/3$ for one case and $k_p = 10$ for the other case, for an average estimate of (80)/9 or nearly 9 classes. This does not seem very satisfactory since we always overestimate the number of classes.

Perspective from NEW YORK

by Milt Stevens

The year ended with the characteristic spurt of activity. One of the most important and desirable achievements to date is the participation of a large number of members in the various projects of the chapter.

Several well attended meetings took place during December. Here are a few excerpts from one held under auspices of the Business Statistics Division:

The Federal Reserve System and the Treasury have exercised conflicting policies with respect to interest rates and credit restrictions, according to *Aubrey G. Lanston,* Executive Vice President of the First Boston Corporation, who claims that by so doing they have increased the area of inflation.

Mr. Lanston sees a danger in the possibility that Treasury debt management operations may make increasing use of non-marketable securities. In such event, the seriousness of the impact of large-scale redemptions could be limited only by selected or wholesale abrogation of redemption contracts. To the extent that this seemed to be in the offing, the only other alternatives would be drastic emergency measures or a substantial extension of other controls over the economy.

Another exceedingly interesting talk was presented at a meeting of the Statistical Techniques Division.

"Getting the most for the least", sums up the functions of Operation Analysis in World War II, declared *B. O. Koopman,* mathematics professor at Columbia University. This was accomplished by designating a specified objective and then utilizing the limited resources available in such a way as to create the greatest achievement. The problems ranged from "reaching a certain military objective" to "the manufacture of a specified number of machines".

In the language of the technician, this was accomplished by (a) maximizing the probability of success for a fixed effort or (b) minimizing the effort necessary to produce a given assurance of success. Teams of scientists—chemists, physicists, astronomers, biologists, mathematicians—worked together to develop a precise formulation, and then a solution by probability theory was sought. A simple illustration of finding a lost ring in one of two possible lots, which many in the audience thought incapable of a precise solution, demonstrated the principles of Operation Analysis.

A third meeting took the form of a conference on "The Future of Research", sponsored by the local chapters of five professional societies. This subject hardly needs review here after the extensive hearings given since early November.

MISCELLANEOUS: *Louise C. Mann* has been appointed head of the Publicity Committee.

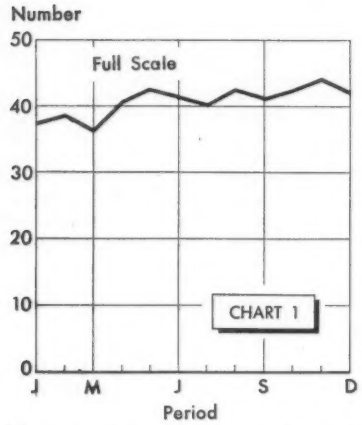
Under the able guidance of *Herbert E. Arkin* and *Robert E. Lewis,* the chapter is preparing an up-dated directory of all statisticians in the New York Metropolitan Area, including members and non-members. All those who have not completed one of the six-question inquiries are urged to do so.

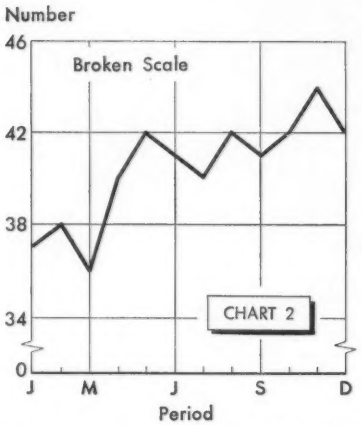
Meredith B. Givens, of the State Labor Department, and *George Garvy,* of the Federal Reserve Bank of New York, have been appointed correspondents for the Metropolitan Area Statistics Division.

Should Scales Extend to Zero? A case for the affirmative

by FREDERICK A. EKEBALD
University of Connecticut

Editor's Note: A recent article on the use of "Double Scales" to compare the relative changes in two statistical series aroused a considerable response. Although the article left much unsaid concerning double-scales, it did serve to demonstrate that interest in scale problems is acute. The present article examines one of the most troublesome of all scale-selection problems. Additional articles on similar topics are planned for future publication.



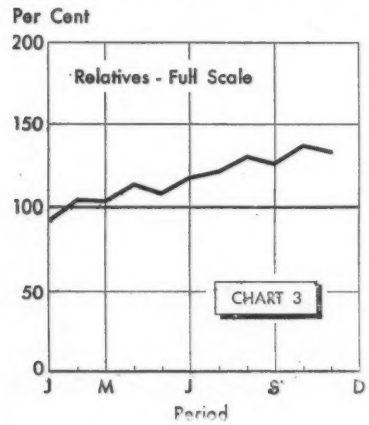


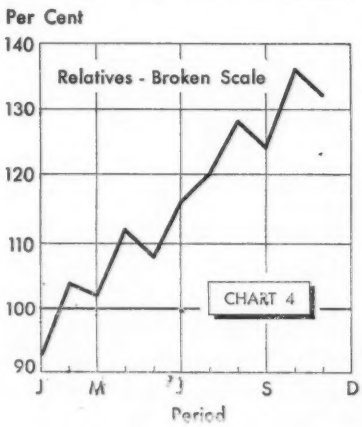
There continues to be a widespread use of poor scales by people and agencies whose work serves as a model of good charting practice for both the layman and the near-expert. Perhaps the most prevalent of these faulty scaling practices is the omission of the zero end of an arithmetic scale.

This article discusses only the question of whether or not the inclusion of zero is important in presenting a single series of data.

The primary function of most charts of this type is to provide the reader with a quick appreciation of the general movement of a statistical series. A proper interpretation of the general movement requires a correct perspective against which to evaluate the significance of the variation which is taking place around the general level (or the "general size" if the series in non-time). Thus, the zero base line is of prime importance in insuring that we have the proper perspective.

Consider the accompanying Charts 1 and 2. Chart 1 is drawn with a full arithmetic scale, from zero through the relevant range of the data: Chart 2 omits about two-thirds of this scale range. (It makes little difference whether the zero value is "shown" as in chart 2, or whether the chart begins with a wavy horizontal line close to some minimum value of the plotted series.) It is obvious that Chart 2 creates the impression of a greater degree of variation in the series than actually exists. As a matter of fact, no clear-cut interpretation can be made of the significance of the charted variation in Chart 2 unless one assumes that the reader has the imaginative powers required to picture in his mind the exact nature of the full scale. Even if the assumption of such imaginative powers were correct, many readers of the chart would be unaware that such powers should be applied for a proper interpretation.





It is almost traditional for the authors of statistical texts to give lip-service to the importance of the zero base and then to give their blessing to devices designed to circumvent the principle. We raise our hands in horror at a chart which accomplishes the same result as the *explicit* scale break, but which does it by an *implicit* scale break. Presumably, it is perfectly proper to "doctor' the scale provided one has the candor to explicitly announce that such doctoring has taken place.

In the same connection, a word should be said about the problem of scales for arithmetic charts of index numbers and relatives.

It is frequently argued that, since the "base" of index numbers and relatives is "100", it is not necessary to draw the full scale down to zero. This argument ignores the fact that the primary purpose of the relatives is to change the sizes of the original numbers to sizes which are more convenient for the analysis at hand. The base of the relatives is still zero, and, from the point

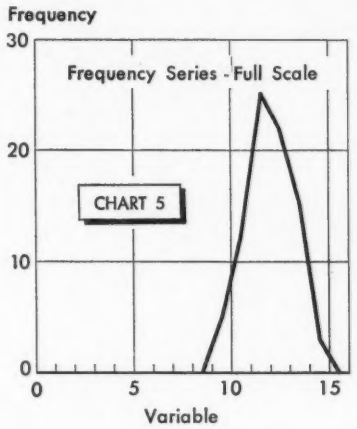
of view of providing the proper perspective for judging the significance of the variation in the relatives, it is essential that the full scale be shown. As in the case of all arithmetic charts, a broken scale will create the impression of greater variation than is actually taking place. Examine Charts 3 and 4 for an illustration of this point.

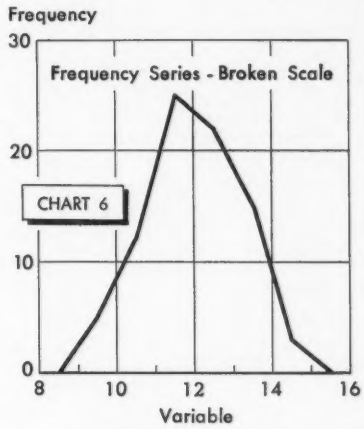
The common practice of failing to start the horizontal scale at zero for the charting of frequency series causes difficulties similar to those mentioned above. Generalizations about the size of the numbers in a frequency series are largely meaningless without an appreciation of the relative dispersion around the generalization. As a matter of fact, the common practice in the charting of frequency series tends to give all series approximately the same relative dispersion, a result which is most certainly contrary to fact. An examination of Charts 5 and 6 will reveal how important this point is.

In this writer's opinion, too much emphasis in charting has been put on the desirability of "balance" in the interests of providing a chart which is attractive to the eye. I would not argue against this principle in general, but, more often than not, reasonably good "design" can be provided in a chart without amputating part of the scale. If the full scale produces a pictured variation so slight that the eye cannot conveniently see it, there would appear to be reason to conclude that the series exhibits only relatively slight variation. Altering the scale to increase the apparent variation merely obscures this fact.

If the intention is to "blow-up" the variation for close inspection, other methods would seem to be more correct than to increase the variation artificially. Direct measurement of the variation would be one method. Measurement in terms of variation about an average or standard would be another. Still another method, when appropriate, is to show the complement of the series, as for example "per cent of Telegrams not delivered" instead of "per cent of Telegrams delivered."

In any event, it should always be remembered that when the scale does not extend to zero the picture is "out of perspective", and that the mere presence of scale designations does not remedy the distortion. To the technician who prepares such a chart and "knows what he is looking for" such distortion may be irrelevant: but to the general reader who believes what he sees, it often presents an entirely misleading picture.





NEWS about MEMBERS

B **Howard G. Brunsman,** formerly Assistant Chief of the Population Division, Bureau of the Census, has been appointed Chief of that Division.

C **Dwight W. Chapman** has been appointed Deputy Executive Director of the Research and Development Board.

Sidney J. Cutler has left the School of Aviation Medicine, Randolph Field, Texas, to work with the United States Public Health Service in connection with the Cancer Control Board.

E **Daniel R. Embody** has left the Arnold Bernhard Company in New York and established a small statistical laboratory in Spirit Lake, Idaho. He will work in research and the application of statistical methods to research problems. The laboratory will also handle routine statistical calculations.

F **Frederick R. Foote** has transferred from the Minneapolis Regional office of the Social Security Administration to the national office . . .

Arnold L. Franseen, formerly with the Research Division, Coordination Service, Veterans Administration, has transferred to the Progress Reports Branch, Statistics Division of the Munitions Board.

G **Robert B. Gardner,** formerly with the Federal Crop Insurance Corporation and the Boston Quartermaster Department, is now with the Franklin Life Insurance Company of Springfield, Illinois, in the capacity of Assistant Statistician.

H **George R. Harvey,** Statistical Laboratory, Iowa State College, has transferred to the State of California Agricultural Statistician's office.

K **Damodar D. Kosambi,** professor of mathematics at Tata Institute for Fundamental Research in Bombay, has joined the mathematics department of the University of Chicago as a visiting professor during the winter quarter. He has come to this country on a UNESCO grant and will lecture at Princeton and Harvard later this year.

L **S. Peter Langhoff** has been appointed Vice-president and Director of Research of Young & Rubicam, Inc. During the war, Dr. Langhoff, as chief statistician of the Army Service Forces, directed the statistical control of procurement and distribution of ground armament and equipment. Recently he has served as a consultant with the Hoover Commission for the Organization of the Executive Branch of the Government and to the Office of the Secretary of Defense.

Michigan University,
General Library,
Ann Arbor, Michigan.
A/S
FMF

M **Paul L. Munson** has resigned as head of endocrinology research for Armour & Company, Chicago, to accept an appointment as research assistant professor in the Department of Pharmacology, Yale University School of Medicine.

P **Kurt Pohlen** has been appointed Assistant in the Graduate School of St. Louis University, Department of Hospital Administration. Dr. Pohlen will be teaching public health statistics and hospital statistics at the University but will also continue as Director of Research and Statistics of the Catholic Hospital Association of the United States and Canada.

R **Donald C. Riley,** Deputy Chief, Division of Statistical Standards, Bureau of the Budget, has returned from Paris where he served as the United States member of a committee advisory to UNESCO on the establishment of its statistical program.

S **Henry S. Shryock, Jr.,** formerly chief of the Population Statistics Section, Bureau of the Census, has been appointed Assistant Chief of the Division. **Lewis B. Sims,** detailed to the Hoover Commission this summer from the Census Bureau, has transferred to the Public Health Service to work on problems of general administration and Federal—State-local relations in the field of environment health.

T **Leon E. Truesdell,** formerly Chief of the Population Division, Bureau of the Census, has been appointed Chief Demographer in the Office of the Director.

V **Harry Venneman,** Associate Clearance Officer, Bureau of the Budget, will aid Stuart A. Rice in his capacity as U. S. Member of the UN Statistical Commission.

W **Faith M. Williams,** Bureau of Labor Statistics, served as Advisor to the United States Commissioners of the Caribbean Commission at the meeting of the Third Session of the West Indian Conference in Guadeloupe, French West Indies, in December.

Deceased: Andrew J. Surratt
C. A. Verrijn Stuart

CHAPTER NOTES

BOSTON

Thirty-one members and guests of the Boston Chapter attended the fall meeting in November. Professor Charles H. Bliss, President, extended an invitation to the National Association to hold its 1951 annual meeting in Boston.

Dr. Joseph L. Snider, Professor of Business Economics at the Harvard Graduate School of Business Administration.

CHICAGO

January 1, Dr. Ernst A. Dauer, Director of Consumer Credit Studies, Household Finance Corporation, spoke on "Consumer Credit—The Long View and the Short View". He discussed the development of consumer credit, its present status, and its significance in our economy.

January 11, Miss Lucile Derrick from the University of Ilinois, at the Statistical Techniques Luncheon Group, discussed three of the basic distributions used in statistics: the Binomial, the Normal, and "Student's" T. These distributions and the tests based upon them are fundamental in elementary statistical methods.

February 16, Dr. Louis Bean, U. S. Department of Agriculture, discussed "The Outlook for Agriculture".

CONNECTICUT

At the annual meeting of the Connecticut Chapter in December, Kent Healy, Professor of Transportation and of Economics, Yale University, spoke on "Some Major Current Problems of Transportation".

DENVER

Mark Benson, Research Associate in the Bureau of Business Research, University of Colorado, spoke at the January 13 meeting on "Inside the Colorado Manufacturing Survey". Following this talk, Mr. Crampon also of the Research Bureau, led the discussion.

NEW YORK

Statistical Techniques Division March 8 Theodore W. Anderson will speak on "Applications of Multivariate Analysis".

April 5 Frederick F. Stephan will discuss "The Design of Sampling Procedures in Relation to Costs and Error Measurement".

May 10, the final meeting of the division, will hear Max Sasuly speak on "Analysis of Interrelation in Economic Series—A Progress Report".

Social Statistics Division is completing arrangements for a forum on INDEXES TO HEALTH to be presented in February.

Metropolitan Area Statistics Division had a series of two meetings in January on "Wage Rates and Levels in This Tri-State Metropolitan Region".

The New York Chapter would like to extend an open invitation to all meetings to out-of-towners when they are in the city. Non-members are also cordially invited.

WASHINGTON

"The Economic Outlook for 1949" was the subject of the January meeting of the Washington Statistical Society. Leon H. Keyserling, Vice Chairman of the Council of Economic Advisors and Emerson P. Schmidt of the Chamber of Commerce of the United States were the speakers of the evening.

Howard J. Myers, Policy Statement Director of the Committee for Economic Development was chairman of the meeting.

SAN FRANCISCO

Officers for 1949:

President: William A. Spurr, Professor of Business Statistics, Stanford University

Vice-President: Bernard Etcheverry, Director, Cost and Commercial Planning, Kaiser Company

Secretary-Treasurer: Harry Schwartz, Research Specialist, Federal Reserve Bank

The activities of the San Francisco Chapter for the year 1948 were concluded at a dinner meeting held on December 7, at which Mervin D. Field, Director of *The California Poll,* and M. I. Gershenson, Chief of the State Division of Labor Statistics and Research, spoke on "What's Wrong with Public Opinion Polls".